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# JOURNAL

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### NOTES ON NORTH AMERICAN CICADAS WITH DESCRIPTIONS OF NEW SPECIES.

By WM. T. DAVIS,

STATEN ISLAND, N. Y.

In 1906 Distant's catalogue of the Cicadidæ of the world appeared, and it has since been an invaluable guide with reference to the literature of our North American species. The writer has, however, suggested on several occasions that some of the names appearing as synonyms really represented valid species, as for instance in this JOURNAL for March, 1915, where the seven names listed under *Rihana grossa* were stated to represent five species. Most of these names had been proposed by Francis Walker in 1850 and 1858, and fortunately many of his types are carefully preserved in the British Museum.

In 1920 Prof. Z. P. Metcalf, of North Carolina, sent specimens to Mr. Distant, who compared them with Walker's types. In 1921 Mr. James P. Chapin kindly carried several specimens to the British Museum that were compared for me by Mr. K. G. Blair of that institution. In 1922 Dr. Joseph Bequaert took a still larger number of specimens to the British Museum, and spent some time in making comparisons. To all of these gentlemen I am very greatly obliged for the aid they have rendered. The result of their findings is recorded on the following pages, and it will be noted that no change in nomenclature is necessary except in the case of *Cicada sayi* Smith and Grossbeck (1907), which should hereafter be known as *Tibicen chloromera* (Walker), 1850.

*Tettigonia grossa* Fabricius (1775).

This species was considered in this JOURNAL for March, 1915, p. 2, and the conclusion reached that *grossa* was probably not a native of the United States, and that our large species of the eastern states should be called *auletes* Germar.

Dr. Bequaert reports: "The type is in the Banks Collection; is a male from 'Brazil.' The shape of the opercula is slightly different from that of *auletes*. Length of fore wing 53 mm."

The following four species, namely *sonora*, *literata*, *resonans* and *figurata*, were proposed by Walker, and later the names were placed as synonyms of *grossa* and *auletes* by Distant in 1906. The last two were restored to specific rank in this JOURNAL for March, 1915.

*Cicada sonora* Walker (1850).

Dr. Bequaert reports: "The type is a male without locality label, but with a number referring to an old register where the locality is given as 'N. Holland.' The pruinosity of the abdomen has apparently been completely rubbed off, but there is certainly none on the middle segments. The opercula have the size and shape of those of *auletes*. The color markings are similar, though the yellowish is more extended on the mesonotum than in *auletes*. Length of fore wing 59 mm."

*Fidicina literata* Walker (1850).

Dr. Bequaert reports concerning this insect: "The type is a male without locality. Upon comparison this proves to be identical with *auletes* in size and shape of opercula, in the extension of pruinosity (absent on the middle segments), in the shape and size of the wings. Length of fore wing 58 mm."

*Tibicen resonans* (Walker).

*Cicada resonans* Walker (1850).

A figure of this insect was published in this JOURNAL for March, 1915.

In 1920 Prof. Metcalf sent a North Carolina specimen, which I have seen, to Mr. Distant, and received a reply that it was "identical" with Walker's type.

In 1922 Dr. Bequaert compared a specimen from Mississippi, and reported as follows: "The type is a female without locality. I have

compared it with your specimen of *resonans* and found the two identical. Length of fore wing 53 mm."

***Tibicen figurata* (Walker).**

*Fidicina figurata* Walker (1858).

A figure of this insect was published in this JOURNAL for March, 1916.

In 1921 Mr. Blair stated: "The specimen sent agrees best with *figurata* in distribution of the black markings (though they are a little more extensive and confluent) and in some of the wing veins being black, but the basal membranes of fore wings are brighter yellow."

In 1922 Dr. Bequaert wrote: "The type is a female without locality. Compared with your specimen it agrees perfectly; having narrow wings (length of fore wing 48 mm., greatest width of fore wing 14 mm.); blackish basal cell; orange membranes at the base of the wing; pruinosity over all segments; the markings too are very much alike."

***Thopha varia* Walker (1850).**

Placed as a synonym of *dorsata* Say by Distant (1906).

Dr. Bequaert's memorandum on this specimen is as follows: "The type is a male without locality. It agrees with your specimen of *dorsata* Say, having especially the short and broad wings (fore wing 45 mm. long, 18 mm. greatest width). The markings and especially the pruinose spots of the abdomen are the same."

***Fidicina crassa* Walker (1858).**

This was considered a synonym of *dorsata* Say by Distant 1906, and Dr. Bequaert was requested to compare the type with specimens of *dorsata* and *dealbata* Davis. His findings are as follows: "The type is a male without locality. It agrees also with *dorsata* Say (length of wing 43 mm.; width of wing 18 mm.)."

***Tibicen chloromera* (Walker).**

*Thopha chloromera* Walker (1850).

*Cicada sayi* Smith and Grossbeck (1907).

*Chloromera* was placed as a synonym of *Rhina tibicen* Linn. by Distant (1906), but as this last-mentioned species was described from Madame Merian's figure of a Surinam or South American insect, as



shown by Smith and Grossbeck, Entomological News, April, 1907, and as no native insect has been found to fit the figure, it is concluded that it is not a North American species.

The original description of *chloromera* is in part as follows: "Body black above, tawny and tinged with green beneath: head a little narrower than the fore-chest, adorned with several small tawny marks, and on each side of the front with one of larger size; face slightly convex, not at all prominent, adorned with a pale tawny elliptical mark, tawny with blackish bands on each side in front: mouth tawny with a pitchy tip, reaching the middle lips: eyes rather prominent: scutcheon of the fore-chest adorned with two oblique black stripes, which are united behind; fore-border black excepting a little interval in the middle; hind-scutcheon [posterior margin of pronotum] adorned on each side with three greenish tawny spots, one large, the other two small; sides not angular, but slightly excavated in front and slightly convex near the base of each fore-wing: scutcheon of the middle-chest adorned with a tawny slender double U-shaped mark whose inner sides are interrupted in front and behind, on each side of this are two oblique tawny stripes which are united behind; the middle pair are broader than the other pair, and their inner sides are excavated; hind border slightly excavated in the middle; cross-ridge tawny: abdomen obconical, longer than the chest, black above, tawny beneath: drums very large, pale tawny, much more than half the length of the abdomen, slightly overlapping . . . wings colourless, bright green at the base; veins ferruginous, green towards the base and along half the length of the fore border; first and second cross-veins clouded with brown. Length of the body 17 lines; of the wings [expanse] 48 lines."

This description seemed to cover *sayi* so well, particularly the statement concerning the long opercula, that Dr. Bequaert was requested to try and find Walker's type and compare with a male and female *sayi* sent for that purpose. His report is as follows: "The type is a male with a label 'T. W. Harris, N. America.' It has large opercula; no black stripe on the under side of the abdomen; the wing is evenly bent on the outer margin; the uncus is shaped as in *sayi*; the markings of the thorax are much the same. I should regard this as *sayi* S. & G."

**Tibicen azteca** (Kirkaldy) 1909.

*Cicada pallida* Distant (1881), preoccupied.

A figure of this insect was published in this JOURNAL for December, 1917. Dr. Bequaert compared a male from Oklahoma with the type, and reported as follows: "The type is a male without locality label. It agrees exactly with your specimen, especially in the shape of the opercula. There are in the British Museum collection next to the type of *pallida*, two males and one female of this species, from 'Texas, Belfrage.'"

**Tibicen olympusa** (Walker).

*Fidicina olympusa* Walker (1850).

*Cicada milvus* Walker (1858).

*Cicada sordidata* Uhler (1892) was placed as a synonym of *Cicada viridifascia* by Distant (1906), but was instead considered a synonym of *olympusa* in this JOURNAL for March, 1916, p. 59, and the insect was figured. In 1921 a male from Florida, the type locality, and known to be *olympusa*, was compared by Mr. Blair, and he reported as follows: "The specimen sent agrees well with both above types [*olympusa* and *milvus*] except that black markings of both pro- and mesothorax are more intense and more extended (in the types the lateral marks on mesothorax are more shadowy and distinctly smaller than the median pair). In the types the basal half of costa is distinctly greenish without black vein, as indeed are all the veins except towards the apex of the wing."

**Tibicen viridifascia** (Walker).

*Cicada viridifascia* Walker (1850).

*Cicada reperta* Uhler (1892).

*Cicada viridifascia* Walker was so identified from Florida by Mr. E. P. Van Duzee in the Bulletin of the Buffalo Society of Natural History, 1909, p. 184, and in this JOURNAL for March, 1916, p. 60, the writer suggested that *Cicada reperta* Uhler (1892) was a synonym. In 1920 Prof. Z. P. Metcalf sent to Mr. Distant a specimen from North Carolina known to be *reperta*, which Mr. Distant stated was "identical" with *viridifascia*.

**Okanagana occidentalis** (Walker).

*Cicada occidentalis* Walker (1866).

In 1921 a female of what was thought to be *occidentalis* from

Wallace, Idaho, and two female *bella* from Utah, were compared by Mr. Blair with specimens of *occidentalis* in the British Museum. He reported as follows: "I am unable to find the type specimen, which should bear the reg. no. 64.18, but there are 6 other specimens collected by J. K. Lord, one of which bears the name *occidentalis* in Walker's handwriting. These may be regarded as cotypes, and place the identity of the species beyond question. They agree well with the specimen sent with this name. They are placed by Distant, both in the collection and in his catalogue, as synonymous with *O. rimosa* Say, but I believe that two, if not three, species have been here confused; *O. occidentalis* being distinguished by the clear, or nearly clear, basal cell, the narrow orange posterior border of the pronotum not extending up the sides, etc."

In 1922 Dr. Bequaert was given a female *occidentalis* from Wallace, Idaho, a female *bella* from Stockton, Utah, and a male *rimosa* from Cumberland, Maine, for comparison. He reported as follows: "The true type is lost, but another female with a label '*occidentalis*' in Walker's writing has been selected by Distant as cotype. It has the last ventral segment twice notched as in your *occidentalis*."

With the specimens handed to Dr. Bequaert for comparison were cicadas related to those about which information was sought and they received due consideration. They were *pruinosa*, *linnei*, *lyricen* and *similaris*; also *marginalis*, *resh* and *dealbata*.

*Tibicen pruinosa* (Say). Variety. Pl. II, Fig. 1.

In the summer and fall of 1921 Miss Louise Knobel of Hope, Arkansas, sent me 236 males and 243 females of this species. It is remarkable that more females than males were collected. Under date of August 25, 1921, she wrote that *pruinosa* was present in great numbers and sang in the late afternoon. On September 15 she wrote: "Maybe you don't know that Mr. *Pruinosa* is Hope's greatest nuisance this season . . . the chorus is very loud from about 3 till 7 P.M. . . . nearly all I have sent you were taken in town from our shade trees at all hours of the day, but mostly from 3 till 7 P.M. while singing." In 1922 Miss Knobel heard the first *pruinosa* on June 12, singing about midday. At Hallowell, Kansas, Dr. R. H. Beamer heard the first one singing on June 25. Mr. A. E. Brower has collected them on several occasions in October at Willard, Missouri, and

Miss Anna Bennett collected a male at Hydro, Oklahoma, in October, 1915.

Among the great number of specimens sent by Miss Knobel there was a remarkably colored individual which is figured on the accompanying plate. It is a female and has a dorsal line of silvery pruinose spots on the abdomen, one on each segment. This is interesting because several species of cicadas, as for instance *dorsata*, *dealbata* and *bifidus*, regularly have a dorsal line of spots on the abdomen, and *marginalis* occasionally has. In *pruinosa* such a condition seems to be of great rarity, and shows an interesting tendency of maculation. In *linnei*, *figurata* and *similaris*, there is occasionally in fresh specimens an inconspicuous dorsal line of golden pubescence on the abdomen.

*Tibicen robinsoniana* Davis.

This species was described from Virginia in the March, 1922, number of this JOURNAL. Recently two males have been found in my collection from Hollister, Missouri, collected by Dr. Harry H. Knight, July 22, 1915. This considerably extends the known range of the species. Dr. Knight at the time wrote me that these particular specimens had a peculiar song, stating: "The one labeled *z-z-zip* is a species that I found among black-jack and other scrub oaks on the flint ridges."

\* \* \*

In Biologia Centrali-Americana, Distant described *Cicada hilaris* and *Cicada intermedia*,<sup>1</sup> both from "Mexico"; the description of *intermedia* is very brief. The writer has had for some time several specimens of a cicada marked "*intermedia?*" and recently Dr. Paul B. Lawson of the University of Kansas sent an additional specimen. This last was photographed both above and below, and the pictures sent to the British Museum. Mr. W. E. China kindly compared these with the type of *intermedia*, and reports that my specimen appears to be distinct, "by the greater width of the head, larger size and in the color markings and pilosity. *Intermedia* has two white pilose spots on the inner margins of the tympana, and a white pilose band at the base of the first abdominal segment on either side. There is no white

<sup>1</sup> Both of these names had been previously used when Distant described these cicadas in 1881, and were therefore preoccupied.

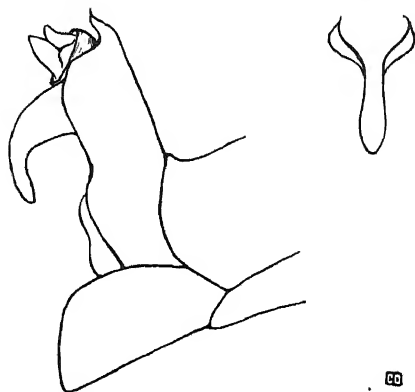
edge to the mesonotum as indicated in the photograph, nor are there two light spots on the anterior margin of the mesonotum." The basal cells of the tegmina are ochraceous in *intermedia* "with a dark spot anteriorly towards the apex of the cell. The opercula are of the same shape and size in both specimens. *Intermedia* has the basal cross vein of the second and third apical cells suffused with piceous." It expands 57 mm.

From *Cicada hilaris*, as described and figured in Bio. Cent.-Am., the specimens under consideration differ in having a proportionately broader head (broader than the base of the pronotum) and in being larger. Also the basal margin of the eighth abdominal segment (called sixth in description) is creamy white as stated both in the text and shown on the plate. *Hilaris* expands 52 mm.

From the above we conclude that the following species is distinct.

**Tibicen chiricahua** new species. Pl. I, Figs. 1, 2, and 3.

Head across eyes broader than the posterior width of the pronotum; front moderately produced; no median sulcus, transverse rugæ well defined. Many white hairs on the face, the remainder of the under side of the body with but few hairs except on the legs. The opercula are broadly rounded at extremities and overlap; the last ventral segment is not truncated, but is rounded and feebly notched at the extremity. Uncus bent as shown in the illustration, and not forked at the extremity. Sides of the body conspicuously parallel for a considerable distance, more so than in *townsendi*, *bifidus*, or *duryi*, which it somewhat resembles. The tip of the abdomen of the female gradually tapers about as in *duryi*; is more drawn out than in some other species that have the last few segments rather suddenly constricted.



TIBICEN CHIRICAHUA

Body above black; head with an orange spot at base and apex of front, one on each lateral and two on posterior margin. Pronotum with large dull testaceous spots centrally; lateral and posterior margins black edged with orange, also an orange line on the front margin for about the length between the eyes; the orange is broadest on the sides near rounded posterior angles. Mesonotum with two curved orange colored lines centrally extending backward from the front margin about half way to the cruciform elevation, and in the allotype, as well as in some of the paratypes, there is a silvery, pruinose spot bordering outwardly, each of the curved lines near its anterior extremity. Outer margin of mesonotum and near the base of both pair of wings also pruinose. The cruciform elevation is orange, black centrally, with a black band crossing each of the anterior limbs. Abdomen black above with a rather large dull orange spot centrally and a pruinose silvery spot at the inner anterior margin of each tympanum. Also, silvery pruinose each side on segment three, and slightly on the other segments to eight which is slightly pruinose on its posterior two thirds, the basal third being black. There is also a feeble orange spot each side on segment eight. In the allotype the posterior margin of segment eight is pale. Underside of body salmon colored, particularly the opercula and central part of the abdomen, otherwise variegated with black about the face, legs, and along the sides, the ventral part of the abdomen being almost entirely pale in some specimens. Fore wings with the basal area dark, lighter near the inner margin, surrounding veins orange or orange and black; venation darker about marginal cells; first and second cross veins clouded. The basal membranes of both pair of wings are grayish tinged with orange.

## MEASUREMENTS IN MILLIMETERS.

	Male Type.	Female Allotype.
Length of body.....	28	22
Width of head across eyes.....	9.5	8.25
Expanse of fore wings.....	71	60
Greatest width of fore wing.....	11.5	10.5
Greatest width of operculum.....	6	
Greatest length of operculum.....	7.5	

Type male, Pinery Canyon, Chiricahua Mts., altitude 6,000 ft., Cochise Co., Arizona, June 12, 1919, and allotype female from same locality, June 25, 1919 (Witmer Stone). Collection Academy Natural Sciences, Philadelphia.

In addition to the type and allotype the following specimens have been examined: Pinery Canyon, Chiricahua Mts., Arizona, June 30, 1919, female (A. Wetmore), expands 62 mm.; Nogales, Arizona, August, male (Oslar), expands 69 mm.; Magdalena, New Mex., male (Strickler), expands 73 mm., and in collection of the University of Kansas.

The following species resembles *Tibicen chiricahua*, but is much larger, and has differently shaped opercula and uncus. Only the type is known.

*Tibicen parallela* new species. Pl. I, Figs. 4 and 5.

Head across eyes broader than the posterior width of the pronotum; front moderately produced, no median sulcus; transverse rugæ well defined. Many white hairs about the face, also numerous hairs on the under side of the abdomen, more than in *chiricahua*. The opercula overlapping at base with extremities rounded, but not as broadly so as in *chiricahua*; they are more spreading toward the tips and in shape resemble those of *townsendi*. Last ventral segment broad at the extremity and with a shallow, open notch. Uncus as in the illustration, broad at the base and with the apical part not as slender and curved as in *chiricahua*. Sides of the body noticeably parallel, about as in *chiricahua*.



TIBICEN PARALLELA

Body above black, with a rusty appearance, owing to being sparsely covered with scattered, short, pale hairs, that are particularly abundant about the cruciform elevation, and on the abdominal segments. Head with an orange spot at base and apex of front, otherwise black above. Pronotum black. Mesonotum with two curved orange colored lines centrally extending backward from the front margin about half way to the cruciform elevation. Outer margin of mesonotum, and near base of both pair of wings, orange. The cruciform elevation is black, fore limbs orange, each crossed by a black band. Abdomen black above with a small pruinose spot each side at the base of segment three; also segments three to eight inclusive with a dull orange spot each side at the posterior angle. Under side of body pale, pruinose on each side of the abdomen, also about the base of the legs. Fore wings with the basal area clouded about as in *townsendi*, and not as darkly so as in *chiricahua*; the first and second cross veins hardly clouded; the venation in both pairs of wings brownish, costal margin paler. Membranes at the base of the fore wings are bright orange, more so than in any related species except *duryi*, where they are reddish in color. The anal vein bordering this orange membrane

anteriorly is broad and dark colored, showing conspicuously in contrast. The basal membrane of hind wings is not quite as highly colored.

#### MEASUREMENTS IN MILLIMETERS.

	Male Type.
Length of body.....	32
Width of head across eyes.....	12
Expanse of fore wings.....	87
Greatest width of fore wing.....	12.5
Greatest width of operculum.....	6
Greatest length of operculum.....	7.5

Type male, Albuquerque, New Mexico, August 20, 1911 (Osler). Davis collection.

#### *Tibicen knighti* Davis.

This species was described and figured in this JOURNAL for December, 1917, from five males collected in Sabino Canyon of the Santa Catalina Mountains, Arizona, altitude 6,500 to 7,000 feet. A further note on its habits appeared in the March, 1921, number. In 1921, Mr. Edward P. Van Duzee collected eight specimens of this species while on a trip along the shore of the Gulf of California, and kindly sent them to me for examination. The records are as follows: San Pedro Bay, Sonora, Mex., July 7, 1921, 2 males; San Carlos Bay, 3 males and 2 females, July 8, and one male, July 9, 1921. The specimens were fresh and the dorsal surface, except where rubbed off, quite generally covered with short, soft, silvery colored prostrate hairs. The last ventral segment of the female is not broadly notched with a second notch within, as in *castanea*, but quite the reverse; it is singly notched, and on each side of the notch the margin of the segment is produced into points. It is really within the area of this projection that the notch occurs.

Mr. Van Duzee wrote of this insect: "The larger species from San Carlos Bay had a louder chirp or song which sounded farther away than it really was, but was not difficult to locate, and the insect did not seem at all timid; I think I took all I heard."

*Pacarina puella* new name. Plate II, Figs. 3 and 4.

In Mr. Van Duzee's Catalogue of the Hemiptera of America North of Mexico (1917), *Pacarina signifera* (Walker) is recorded from Texas and Central America. The species was described by Francis Walker in 1858 as *Cicada signifera* from Orizaba, Mexico. Lately



in looking over a copy of Germar in Thon, Ento. Archiv., ii, 2, p. 7 (1830), the name *Cicada signifera* was noticed. On page 144 of Distant's Catalogue of 1906 he credits the species described by Germar to South Africa, and places it in the genus *Psilotympana* Stål (1861). On page 8 of Germar's paper of 1830 he describes a second *Cicada signifera* giving the locality as Brazil. Later in Silb. Rev. Ent., ii, p. 63 (1834), Germar changed the name of this second *signifera* to *Cicada stigmatica* (see Distant's Catalogue, 1906, p. 134).

From the above it is evident that in 1858 when Walker described his *Cicada signifera* two other cicadas had already received that name from Germar and one of the names was in good standing. It would therefore appear that Walker's *signifera* should receive a new name, and *Pacarina puella* is here proposed.<sup>1</sup> It is a surprise that Kirkaldy did not bestow one in his article on "Hemiptera Old and New," Canadian Entomologist, 41, p. 391, 1909, when he changed a number of preoccupied names of cicadas. Among our North American cicadas that have received new names for the reason mentioned are *Cicada marginata* Say, 1825, changed by Walker to *Cicada marginalis*, 1852, and *Cicada pallida* Distant, 1881, changed by Kirkaldy to *Cicada asteca*, 1909. The name *calloipe* Walker, 1850, now placed in the genus *Melampsalta*, has taken the place of *parvula* Say, 1825, and *pallesceus* Germar, 1830, for the reason that both of these names were preoccupied at the time they were proposed.

\* A Guatemalan specimen of this species is figured under the name of *Proarna signifera* by Distant in Biol. Centr.-Amer., Rhynch. Hom., t. ii., fig. 21. In the writer's collection there are two males and a female labeled Monterey, Mexico, July, 1899, received from Prof.

\* E. D. Ball. In the eastern half of Texas the species appears to be rather common. Specimens have been examined from Brownsville, Victoria, Floresville, Gillette, Rio Frio, Sabinal, Hondo, San Antonio, Anhalt, Southerland Springs, New Braunfels, Kerrville, Baby Head and Chillicothe. The dates of capture for the Texas specimens are in May, June and July. In the U. S. National Museum there is a male labeled Alexandria, La., Aug. 12, 1910 (H. Pinkun). As far as the writer is aware this is the first published record for Louisiana.

\* <sup>1</sup> This change is supported by the ruling in Entomological Code, by Banks and Caudell, where it is stated: "In case of primary homonyms the later name shall be changed, no matter to what genus they are now referred."

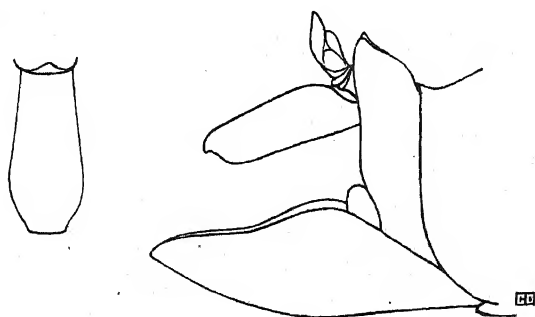
The insect also probably occurs in Oklahoma, as Chillicothe, Hardeman County, Texas, is near the border line.

In the Annals and Magazine of Natural History (8), vol. 8, p. 134 (1911), Distant states that the species was "only previously known from Central America. The Geneva Museum possesses a series of specimens taken at Dallas, Texas. Some of these agree with the typical form, others have the spots on the mesonotum nearly confluent, thus giving it an almost black appearance. Others, apparently bleached specimens, have nearly all of the macular markings obliterated, including those on the tegmina."

**Okanagana nigrodorsata** new species. Pl. II, Fig. 2.

Resembles both *occidentalis* and *bella*, but is almost wholly dull black on the dorsal surface of the body, except for some small inconspicuous spots on the front of the head and at the base of the wings. It is not as shining as in *occidentalis*, nor blue-black and shining as in *bella*. It also may be separated by the elongate-shaped uncus, which is figured. From *ornata* it differs greatly in color, and in the shape of the last ventral segment both in the male and female.

Head rather small and not quite as broad as the front margin of the pronotum; front moderately produced, about as in *bella*, and more so than in *occidentalis*; median sulcus well defined. Pronotum with the humeral angles rounded; the anterior angles prominent and slightly rounded. Sides of the pronotum usually with a few irregular sinuations. Last ventral segment with the sides curved inward to the extremity which is somewhat truncate, rounded at the sides or outer angles.



O KANAGANA NIGRODORSATA

Uncus when viewed in profile not hooked at the extremity and much slimmer in proportion to its length than in either *occidentalis* or *bella*; when viewed from behind, with a shallow notch at extremity. Last ventral segment of the allotype doubly notched. Fore and hind wings with the costa pale

orange to the end of the radial cell, darker beyond. Venation of both fore and hind wings dark in color; basal cell almost black. Membranes at base of all wings orange variegated with black, especially on the hind wings. The wings are of the broad type, as in *occidentalis* and *bella*, and not of the narrower form, as in *rimosa*.<sup>1</sup> Head black except the supra-antennal plates, and narrow, interrupted, transverse stripe in front of the anterior ocellus, which are pale. Pronotum black. Mesonotum and metanotum black except a small orange spot at the base of each wing. Tergum black. Uncus black; valve black, edged above with pale, also a pale spot on under side. Abdomen black beneath, each segment edged on the posterior margin with orange. Legs contrastingly variegated with orange and black; upper side of femora and about one half of each tibia black, then almost wholly orange to end of legs, except claws, which are darkened.

#### MEASUREMENTS IN MILLIMETERS.

	Male Type.	Female Allotype.
Length of body.....	24	23
Width of head across eyes.....	7	6.25
Expanse of fore wings.....	60	61
Length of valve.....	5	

Type male, Mt. Hough, Plumas Co., Calif., 7,000 ft., June 19, 1918 (Frank Morton Jones). Davis collection.

Allotype female, near Davis Creek, Modoc Co., Calif., July, 1922 (Dr. A. W. Lindsey). Davis collection.

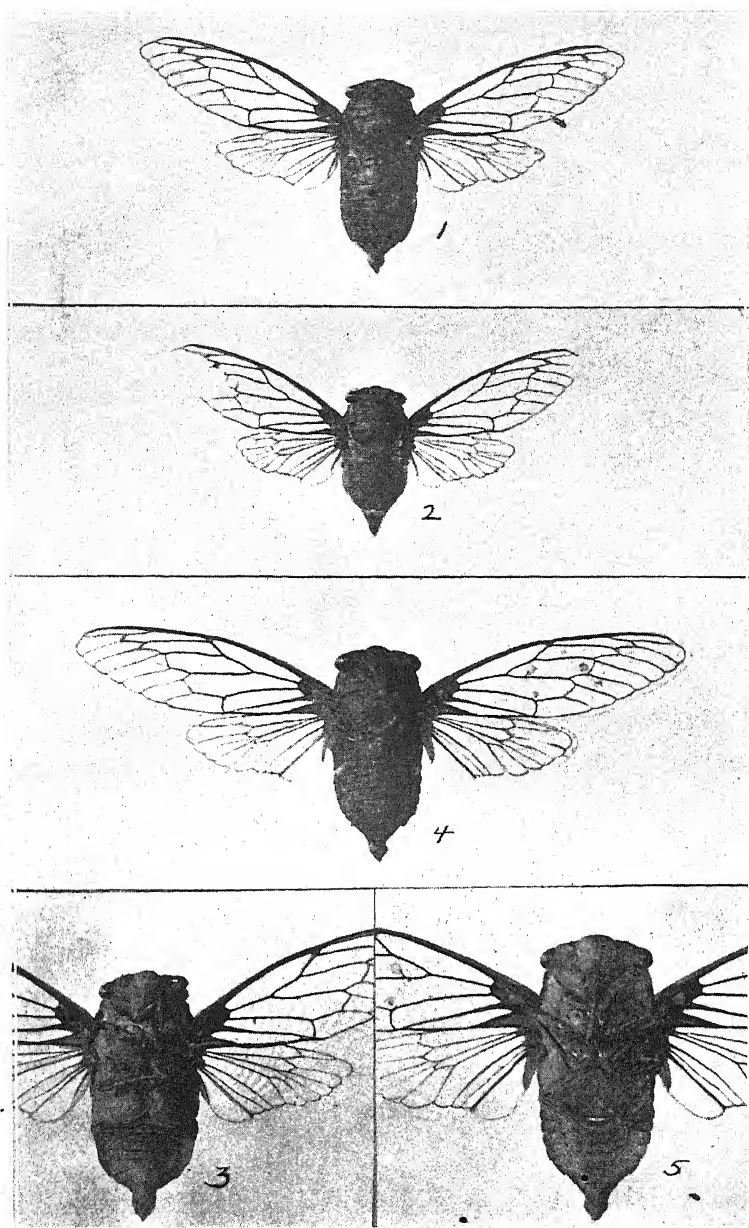
The following paratypes have been examined: Webber Lake, Calif., July 23, two females (O. Sacken); Tuolumne Co., Calif., two females (no date label), also male with no locality or date label, collection U. S. Nat. Museum. Angora Lake, Tahoe, Calif., July 11, 1915, three males (E. P. Van Duzee), collection Calif. Academy of Sciences. Onion Valley, Calif., "8, 9, 13," male (H. E. Burke), and Tuolumne River, Sierra Nevadas, Calif., elevation 8,000 ft., July 11, 1922 (Victor Duran), writer's collection.

#### *Okanagodes gracilis* Davis.

This curious insect, with a protruding front and a narrow pronotum, was described and figured in this JOURNAL for June-September, 1919, and later a note on its discovery by Mr. Morgan Hebard at Bagdad, San Bernardino, Calif., in August, 1919, appeared in the March, 1921, number.

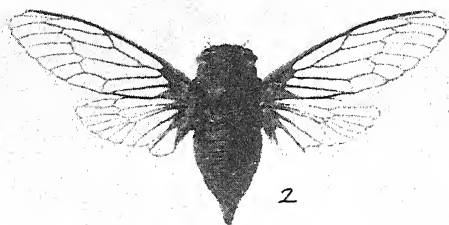
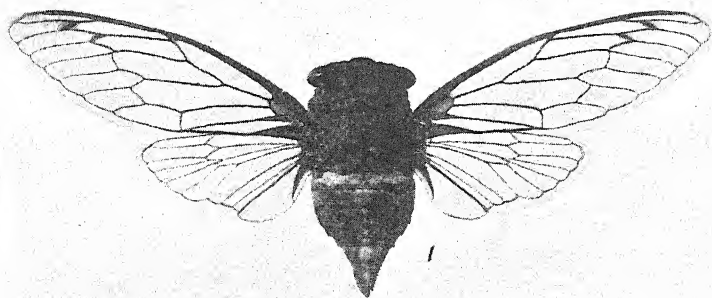
Mr. Edward P. Van Duzee has sent me six specimens for examination that have been placed at least for the time being under this name, for ultimately they may prove to be a second species of *Okanagodes*. They show slight structural differences, they are generally

<sup>1</sup> See JOURNAL, N. Y. Ento. Soc., Vol. XXVII, pl. XX.



CICADIDAE





CICADIDAE.



smaller and much darker in color than specimens from Utah, Arizona and California. They were collected as follows: Smith's Island, Angles Bay, Gulf of Calif., June 27, 1921, male (J. C. Chamberlin); Angel de la Guardia Island, Pond Island Bay, Gulf of Calif., June 30, 1921, female, and July 1, 1921, three males and one female (E. P. Van Duzee). Mr. Van Duzee writes: "The small species from Pond Island Bay was taken on weeds and grass or even on the stones, on a rocky hillside a few feet above the floor of the valley; they have a short, sharp chirp like a house cricket only fainter, which was audible about 75 feet."

#### EXPLANATION OF PLATES I AND II.

##### PLATE I.

- FIG. 1. *Tibicen chiricahua*. Type.  
FIG. 2. *Tibicen chiricahua*. Allotype.  
FIG. 3. *Tibicen chiricahua*. Enlarged.  
FIG. 4. *Tibicen parallela*. Type.  
FIG. 5. *Tibicen parallela*. Enlarged.

##### PLATE II.

- FIG. 1. *Tibicen pruinosa*. Variety.  
FIG. 2. *Okanagana nigrodorsata*. Type.  
FIG. 3. *Pacarina puella*. Male from Gillette, Texas.  
FIG. 4. *Pacarina puella*. Female from Victoria, Texas.

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## THE LIFE HISTORY OF CHIRONOMUS CRISTATUS FABR. WITH DESCRIPTIONS OF THE SPECIES.<sup>1</sup>

BY HAZEL ELISABETH BRANCH, PH. D.

WICHITA, KAN.

#### INTRODUCTION.

The study of the life cycle of this midge, the larva of which lives in waters charged with milk waste, is an outgrowth of a study in stream pollution that was conducted at Cornell University in 1920-21, the main results of which will be published elsewhere.

In the fall of 1919, Dr. P. W. Claassen of the department of Biology, Cornell University, found bloodworms growing profusely in

<sup>1</sup> A contribution from the Limnological Laboratories of Cornell University, Ithaca, N. Y.



a stream into which a milk plant at Adams Center, N. Y., poured its waste. These bloodworms upon being reared proved to be *Chironomus cristatus* Fabr. As the early stages of this species were undescribed, it was deemed necessary to study its life history and habits. This portion of the work was allotted to the writer, whose observations herein recorded were carried on through a period of one year.

The adults of this species are recorded by Johannsen from the states of New York, Illinois, Washington, Kansas, Idaho, South Dakota and New Jersey; and since it grows in waters of such common contamination it seems peculiar that the early stages have hitherto escaped notice. The larvæ grow readily in waters charged with milk and no difficulty has been experienced in obtaining heavy cultures and having them thrive and maintain themselves in such a medium both indoors and out.

In the indoor experiments, white enamelled steel pans of various sizes were used and in these, water was put to a depth of not less than  $\frac{3}{4}$  of an inch and soil was added to cover the bottom. These pans were then stocked with either egg masses or young midge larvæ. Milk in a known proportion to the volume of water in the pan was added to these pans daily; thus the dilution for the best growing conditions was determined. The water was not changed but sufficient fresh water was added each day to maintain the original volume. By these means the conditions of a semi-stagnant pool were simulated. By screening the pans, several generations of bloodworms were raised in the same pan.

In the outdoor experiments, a sluice of about 125 feet by 3 feet and also a series of three ponds fed by pipes from this sluice were constructed. This sluice and the ponds having been artificially stocked from Adams Center, received milk waste daily. Other forms naturally found their way into these artificial breeding places but *Chironomus cristatus* Fabr. easily maintained itself as the dominant form present. It is the observations that were made under these controlled conditions that are here recorded.

#### LIFE HISTORY.

*Eggs:* The egg masses of *Chironomus cristatus* are to be found at the surface of the water attached to stones, stumps, or vegetation projecting above the surface (Plate III, Figs. 2 and 5). These egg masses

occur in the greatest abundance at points in the stream just above the pollution and where the water ripples over stones and other material. The water movement in such places probably aids aëration and lessens the silt deposits upon the gelatinous envelope of the egg mass. The newly hatched larvæ cannot dispose of as great a percentage of waste per water volume as can the grown larvæ but they require more oxygen. In the ponds and in the breeding pans where no such ripples are available, the egg masses are placed at the edges rather than upon blocks and stones placed in the open water partly submerged.

The egg mass presents a color of light brown due entirely to the eggs, for the gelatine is colorless. The shape of the mass is that of a curved and tapering cylinder. The curvature is more noticeable if the mass be floating freely and moored only by its suspensory stalk (Plate III, Figs. 1 and 3; Plate V, Fig. 30). Frequently, however, the mass comes in contact with something in the water and lies straight. The masses vary in size and measure all the way from 5 to 10 mm. in length and 1 to 2 mm. in width at the middle. The eggs are imbedded in a gelatinous ribbon in which they are set obliquely to the axis of the ribbon and this ribbon is laid back and forth, transversely, to form a hollow cylinder. As the ribbon turns on the inner and shorter edge of the cylinder, the eggs of every other row lie parallel and the adjoining rows face in opposite directions. There are approximately 34 rows of 20 eggs each in a mass, the last 2 to 4 rows being in a spiral to close the cylinder. The mass is suspended by a slender gelatinous thread, which appears like a stalk, with an attachment disc upon its outer end. This disc is not visible unless the stalk fails to adhere to some support and in this case the disc flattens and remains in the surface film and the mass floats freely in the water. Usually the egg mass is just below the surface film which it buoys up slightly above the common level. When the mass is at rest, the attachment thread or stalk is scarcely perceptible, being not more than 0.5 mm. in length; a very short distance after it enters the mass it divides into two equal strands and these traverse the length of the hollow cylinder twisting upon each other rope fashion regularly at every other row of eggs. These strands adhere to each other and to the mass at the smaller end of the cylinder (Plate V, Fig. 30). The attachment thread with its two strands and the egg mass itself are extremely

elastic and while the egg mass itself may elongate to two or three times its original length, the stalk or single thread may stretch to 50 mm. or one hundred times its normal length. When the egg mass is released from the current or whatever has caused this elasticity to show itself, the stalk, strands and mass regain their former length and position. This may be a lotic adaptation protecting the mass from dislodgment by the current. If seized it may the more easily slip out of the mouth of a devourer. There are about 525 eggs in a mass on an average based on a count of 28 egg masses (782, 735, 672, 480, 408, 374, 396, 600, 612, 720, 442, 836, 660, 680, 364, 338, 260, 384, 324, 442, 330, 1440, 378, 255, 306, 440, 510, 544); all of which were hatched and reared and proved to be *Chironomus cristatus*. The eggs measure approximately 0.28 to 0.315 mm. by 0.13125 to 0.14 mm. They taper more toward the anterior end than the posterior end, while one side is slightly flattened (Plate V, Fig. 31).

*Egg laying*: The female in oviposition places herself against the support chosen and balances herself by means of her middle legs and her wings which she extends and moves from time to time. The front legs are held out forward as is their natural position while the hind legs are brought under the body with the distal ends of the tibiae almost together. The tarsi lie at a little more than a 45 degree angle with the tibiae with the most distal segment just barely touching the surface of the water. The abdomen is curved under with the tip below the thorax and almost touching the distal ends of the tibiae. The stalk of the egg mass appears first. It does not adhere to any support as yet but lies between the tibiae. When this stalk has been protruded about 0.5 mm. the ribbon of eggs appears and its end is attached to the stalk and then is swayed backward and forward around the twisting strands of the stalk to form the hollow cylinder described above. The abdomen can be seen to move from side to side as the ribbon is extruded and placed in position and the tip pulsates at the extrusion of each egg. When the ribbon is nearing completion the female moves the abdomen spirally for a few turns and closes the cylinder. The attachment stalk lies between the tibiae just barely touching them, and the tarsi support the egg mass, the outer curve of which is therefore toward them. When the mass is completed, the female rests for a moment, draws the abdomen back into normal position, lifts

her body with a movement of the wings and jerks the tarsi from under the mass and flies off. The mass usually falls so that the attachment stalk meets the support upon which the female placed herself and the mass hangs just touching the water with the surface film drawn up over it. Frequently, however, the egg mass is entirely submerged. The entire process of egg laying, from the time the female selects the place and begins balancing herself until she jerks the tarsi from under the mass, occupies about 10 minutes. The mass is very dark and small when laid upon the tarsi but when in the water it expands to twice or three times its size when extruded.

*Development:* In these eggs, as the chorion is very transparent, much of the embryological development may be observed. The germ cells appear at the lower pole of the egg before it is two hours old. This was first observed by Robin, 1862, and further observed by Weismann, 1865, Balbiani, 1885, and Ritter, 1890. It is the classic evidence for Weismann's theory of the continuity of the germ plasm. The incubation period is short requiring only 2 to 5 days depending directly upon the temperature. An average of eleven cases where the egg laying was observed, and exact time therefore ascertainable, was three days. This covers a period from April 22 to August 7 with a range of temperature of the water from 62 to 78 degrees Fahrenheit. When the embryo is almost mature it is spirally arranged in the compass of the egg to accommodate its increasing length, with its head toward the tapering end. When completely mature the head still retains this position but the tail is no longer in the posterior end for the body has folded upon itself and the caudal end of the embryo lies in the center. The small red eye spots, a pair on each side of the head, and the four anal gills, the caudal prominences with their six hairs each, as well as the anterior and posterior prolegs are clearly discernible.

*Hatching:* When the time for the breaking of the chorion is at hand, the larva moves its head up and down as far as it can reach along one side of the narrow end of the egg until a slit is made and the head crowds its way out. The larva gradually unfolds itself by pushing with its anal feet against the side of the shell opposite the slit and by pulling the body along with its anterior prolegs. The process of breaking the shell is long and the larva frequently makes several

attempts of ten to fifteen minutes duration for several (4 to 6) hours. After the shell is broken the larva may crawl out at once or it may take 15 to 20 minutes to get itself entirely free. The empty egg remains in the gelatinous matrix of the mass which disintegrates after several days. The process of hatching usually begins at the attachment end of the mass and often 24 hours may be consumed in the hatching of a mass. 99 per cent. of the eggs of a mass hatch and even in cases where the gelatinous matrix for some reason disintegrates before hatching time, the greater majority of the eggs come to maturity and hatch into strong larvæ.

#### *Larval Life.*

*First Instar:* At hatching, the larva is very crumpled and the lines of segmentation are confused with wrinkles. The head capsule, from the posterior margin of the dorsal line to the tip of the labrum, is from 0.1225 to 0.1575 mm. and the entire length of the larva is approximately 0.56 mm. Within the hour the larva increases in length to about 0.635 mm. and when one day old measures 1.085 mm. or almost twice its length at hatching. As a head capsule does not change its size except at moulting, we may take this constancy and the change in size as indicative of moult in determining the instars. The teeth of the labial border are more pointed in this first instar than in the later instars (Plate IV, Fig. 10). The anal gills are four in number, the ventral gills are absent. The caudal prominences possess 6 hairs each and the anterior prolegs are clothed with fine curved hairs whereas the posterior ones are fitted with many bifid claws. The color of an individual is creamy and more or less transparent and it is only when a mass of several hundred is seen that a faintly pinkish cast may be detected. For the first day after hatching the larvæ remain upon the old egg mass crawling in and out of the hollow cylinder. Upon the second day they leave the mass and by their characteristic figure-of-eight movement swim about in the water. They collect in masses upon the lighter side of objects in the breeding pans or in the streams and ponds. When three or four days old each one builds a tiny little tube by drawing together soft refuse or small particles of soil and fastening them to each other and to some support by means of a silken substance which is secreted by the larva. These tubes which may not be a millimeter in length serve as habitations and within them an

observer may see the larva undulating its body so as to cause a current of water to pass through the tube which is open at both ends. The current of water bears particles of food which adhere to the silken lining of the tube and these particles are later eaten off by the larva. Frequently a larva reverses its position so as to cause a current of water to pass through the tube in the opposite direction.

The amount of food or volume of waste per volume of water consumed in this instar is small: a thousand larvæ will not take care of more than 0.1 c.c. or 2 drops, in 300 c.c. of water each day. They will, however, thrive in this medium and keep the water clear and odorless. Out of doors the larvæ of this instar are most usually found around the edges of stones or floating particles or vegetation and along the sides of the streams or ponds.

The first instar continues over a range of 4 to 8 days with an average in 21 cases of 5.5 days. This varies with the temperature but around 65 degrees Fahrenheit it is normal to look for the moult about the eighth day. When ready to moult this first instar larva measures approximately 1.575 mm.

*Second Instar:* With the first moulting the ventral gills appear. They are situated upon the next to the last segment of the abdomen and are four in number, a pair at either end of the segment. They are short and stubby being no longer than the posterior prolegs. The remainder of the body is as in the first instar only larger. The head capsule measures 0.21 to 0.245 mm. The labial border still has very pointed teeth but the median tooth instead of projecting beyond the second laterals as in the first instar has come to be on a level with them and the laterals beyond the second are less lanceolate. The color of the individual has become a pinkish brown with a color in the mass of a light red. They are still attracted to the light and collect upon the brighter side of the breeding pans hanging there for hours at a time. Their tubes are longer, the old one having been merely extended, and are still transparent enough for the larva to be seen within. In this instar the food percentage may be raised to 0.2 c.c. per 300 c.c. of water for a thousand larvæ. In the outdoor experiments, the larvæ are found in deeper water and further down upon the stones and vegetation. This second instar has a duration of four to ten days with a normal of seven days. The age of the larvæ varies

from 8 to 18 days with an average of 12 days in 11 cases. Normally we look for the second moult when the larvæ are about 15 days old. When ready for its second moult the larva measures at least 3.28 mm.

*Third Instar:* With the second moult, the ventral gills become longer in proportion to the body, being almost twice as long as the posterior prolegs and curving slightly toward them (Plate IV, Fig. 18). The head capsule measures from 0.42 to 0.45 mm. and the color has become noticeably red. The labial border has its median tooth shorter than the second laterals but is still pointed. The second laterals are becoming more rounded and the laterals beyond the seconds are normal in shape (Plate IV, Fig. 8). The larvæ are no longer attracted to light but remain in the tubes during the day. If surprised with a bright light at night they may be seen wandering about away from their tubes. During the day they may be seen in their tubes making their undulating movements and eating the food particles from the silken lining. The tubes are built closely together even when there is plenty of room in the pan, which is contrary to the condition in the first two instars when the tubes are built far from one another. Their habits are therefore almost reversed in respect to their attraction to light and the position of the tubes. The food percentage may now be raised to 0.5 c.c. per 300 c.c. for one thousand larvæ and this is the best growing medium for a mixed lot of larvæ of all ages. The larvæ of this instar seek the bottom. The instar has a duration range of 11 to 18 days and the age of the larvæ varies from 19 to 36 days with an average of 28 days for 11 cases. We usually look for the change about the 22d day. When ready to make this moult, the larva had attained a length of approximately 5.6 mm.

*Fourth Instar:* In this fourth and last larval instar the individual becomes a bright red with the head almost black. The ventral gills are long and coiled upon themselves, extending backward beyond the posterior prolegs. The head capsule varies from 0.70 to 0.77 mm. and the labial border has taken on the form shown in Plate IV, Fig. 7; the second and third laterals becoming very closely applied to each other. The duration of this stage is extremely variable and at present the controlling factors are unknown. Larvæ from the same egg mass vary from 4 to 23 days, and we have a range for the beginning of pupation from 19 to 64 days after hatching with an average of 27.6

days in 23 cases. Pupation may normally be looked for when the larvæ are about five weeks old. The food content of the water should be about the same as in the third instar but they can stand a higher percentage for a few days and still keep the water clear and odorless. The variation in the length of the life of the larvæ is of economic importance for although the crests of pupation may take place at regular intervals, one may find larvæ in all stages at any one time.

*Pupal Period:* The transformation to pupa usually takes place in the tube but frequently one may see the full grown larvæ, which measure from 14 to 16 mm. in length, swimming about out of the tube and transforming while free from any support. The second and third thoracic segments are brown and swollen and the respiratory filaments of the pupa as well as the compound eyes may be easily seen through the larval covering of the thorax. This condition may prevail for a day or two and then the larva breaks open upon the back of the thorax and the pupa wriggles out, usually not completely extricating itself from the larval skin which covers the posterior part of the pupa (Plate V, Fig. 27). When first transformed the pupa is a bright red with very black eyes and the respiratory filaments extremely white. It remains this brilliant spectacle for about one day and then gradually turns dark and the filaments become gray. Sometimes the pupa transforms to an adult while still in a larval tube but this occurs only when the water is low. The pupa lies upon its side upon the bottom, moving only slightly for two days and then becomes extremely active swimming about by an upward and forward then downward and backward motion of the abdomen bearing now a pair of caudal paddles. The pupa holds the thorax upright and always keeps the respiratory filaments below the surface film. If the filaments do break through before the close of the period the pupa is unable to extricate itself and dies. On the third day the cuticle of the pupa becomes transparent and the body of the adult may be seen within. The pupa now swims with the body in a horizontal position just under the surface film. After swimming or floating for about one day, the pupa suddenly pushes its respiratory filaments through the surface film and stretching out upon the film becomes quiet. The whole pupal period is seldom more than 3 days.

*Adult:* The adult body clearly visible through the pupal skin is



now brilliant red. After a quiescent period of a few moments, the thorax suddenly bursts along the mid-dorsal line and the thorax of the adult appears. It is immediately followed by the head with the antennæ closely folded and then appears the fore part of the abdomen with the bright red wings lying along the sides of the body apparently all filled out and only needing to become dry to be useful. The middle pair of legs are drawn out first and touch the old pupal thorax at the base of the old respiratory filaments. The adult supported on these legs works the body up and down a few times and then the hind pair of legs are released and braced against the old pupal abdomen. The tip of the abdomen appears immediately and the front pair of legs come out at the same time. These legs and the wings flutter a moment and the adult flies from the water. This emergence takes about 10 to 12 seconds at times and again may be accomplished in 4 or 5 seconds. If it be prolonged beyond 12 seconds, the emergence is a failure, the tip of the abdomen and the hind legs seeming to stick.

The adult usually flies off at once but it may rest for several minutes upon the pupal skin or even upon the water, but this last may be followed by disaster. The male antennæ take shape slowly and it may be 10 or 20 minutes before he is in full plumage. The usual time for emergence is at dusk or early in the morning. Upon emergence the adults fly to the light in the indoor experiments, and straight up into the air and are lost to sight when the emergence takes place out of doors. The average time from hatching to emergence is 41 days in 26 cases with a range of 23 to 90 days. As the time of the fourth instar is variable, so is the period during which the adults from an experiment may appear, a long one. In our experiments this period extended from 10 to 81 days with an average of 32.7 days in 21 cases. The range from hatching to the last emergence for a given experiment is 27 to 118 days with an average of 71 days in 20 cases. This variation is also accountable for the continued supply of larvæ in a stream and for the presence of egg masses at almost any period of the summer.

The adults keep in dark corners and weed shelters in the day time and swarm at sunset in great masses, the males making up the greater percentage of the swarm. They move up and down in the air at various levels and remain in the air for a period of about half an hour. Fe-

males may be seen darting in and out of the swarm or sitting quietly near by. Suddenly one of these females will dart into the swarm and catch a male by the thorax with her fore legs, both individuals headed in the same direction. Instantly the male whirls about so as to head in the opposite direction and drops from the swarm carrying the female along behind. The pair drop about five feet and then, without pausing, rise again to about the level of the swarm and separate and both come to rest. In a very few moments, the male returns to the swarm but the female usually remains quiet or crawls about doing very little if any flying. Only those forms which have been emerged long enough to be thoroughly dry mate, or at least none of the mating pairs in our observations showed any red, which is the characteristic color of a newly emerged adult and the color persists for about six hours. A similar process of mating has been observed in this same genus *Chironomus plumosus* Linne by Needham.

Parthenogenesis seems not to occur in this species. Of 52 females that emerged in isolation, only 29 laid eggs and none of these were fertile.

As for the length of life of the adults, the females in captivity where their emergence was known lived an average of 4 days and 15 hours while some lived as long as 8 days. The males show an average of 5 days and 15 hours with an extreme of 17 days. As far as known, the female lays only a single egg mass.

Egg laying certainly does not take place immediately after mating as experiment records show. Three days may elapse from emergence to egg laying in unfertilized females and this same time often elapses between time of capture and the laying of eggs by a fertile female. There may therefore be approximately a week from emergence to the larval stage. This makes a six weeks cycle for the normal cases; and the observations of the crests of emergences and egg laying verify this period. We observed one crest the second week of July, which was probably the second of the season, another the fourth week of August and another the first week of October, making at least four cycles in a season. We had emergents in the indoor experiments as early as April 5th and if this were followed in the open even a week or so later there could easily be five cycles. It is not uncommon to see Chironomids flying in April and to collect eggs at that time,

but until further data is obtainable for this species we will say that there are at least four cycles for the season.

The numbers of the two sexes are about equal as determined by counts of individuals taken from the indoor rearings over a period of three months. The number reaching maturity in these experiments was only 3 per cent. for great fatalities occur at the moults and especially at the change from larva to pupa.

The species overwinters in the larval stage and is extremely resistant to freezing temperatures. Where possible the larvæ burrow into the debris and soil but may be frozen in a solid cake of ice and when thawed out become active and later pupate. They are also resistant against drought. They crawl into the mud as the water recedes; even though the dirt about them be dry enough to crack and crumble, they will revive when water is placed on them and continue their functions.

When milk particles are available nothing else is eaten or at least nothing else can be seen in stomach contents, but if this food be lacking then the larvæ will eat small green algæ. The larva apparently does not eat in temperatures below 37 degrees Fahrenheit and becomes inactive, but resumes activities at any rise in temperature.

*Summary:* We have therefore a species with an incubation period of not more than five days, a larval period of four instars with a range of 24 to 115 days, a pupal period of 3 days and an adult life of 4 or 5 days. The crests of emergence fall approximately six weeks apart and there are at least four, possibly five, cycles a season.

#### DESCRIPTIONS.

*Egg Mass:* Color light brown; 5 to 10 mm. in length, 1 to 2 mm. in width. Individual eggs measure 0.28 to 0.315 mm. by 0.13125 to 0.14 mm. and are set usually on a slight diagonal in a narrow gelatinous ribbon which folds back and forth upon a hollow cylinder to form the mass. There are approximately 34 rows of 20 eggs each but this is variable for the range in numbers of eggs in a mass may be from 255 to 1,440 with an average of 525. The mass may be found attached to a stone or aquatic plant at the surface of the water (usually where there are ripples) by a gelatinous stalk which, when it reaches the mass, divides into two strands which extend the length of the hollow cylinder within the center (Plate III, Figs. 1 and 3; Plate V, Fig. 30).

*Larva:* 14 to 16 mm. in length when full grown, of a bright red color. Head dark brown, bearing two pairs of pigment spots or superficial eyes. The antennæ about one fifth as long as the head and consisting of a large but slender basal joint with one sensory pore and bearing distally two processes, one of four joints of which the first and third are the longest, the other process not jointed and shorter. Labrum prominent and fitted with one pair of dorsal hooks situated near the median line, one pair of ventral hooks lying nearer the median line than the dorsal pair; upon each side of the labrum and toward the distal edge are three hooks longer than the dorsal or ventral pair, which are graduated in length, the longest being toward the front. The anterior comb projects laterally so as to form another pair of hooks. The teeth of the posterior comb, which is a horizontal bar, are similar in shape and size, slender, pale and pointed. The mandibles large with five teeth, the distal one pale, the others black with the one adjacent to the pale distal tooth pointed as a rule but in some cases blunt; a row of hairs upon the inner face of the mesal border of the mandible projects mesad beyond the teeth; there is a single seta near the base of the mandible but upon it. The maxillæ bear a single palpus each and this is terminated with a ring of papillæ; two setæ rise near the base of each maxilla. The labium is dark with a median tooth which is rounded and longer than the first laterals but shorter than the second laterals; the second laterals rounded and closely applied to the third laterals which appear almost as shoulders of the second (Plate IV, Fig. 7). The head shows a distinct clypeal sclerite, upon which are three pairs of setæ, and two lateral sclerites which are joined ventrally and each sclerite bears dorsally two setæ. Upon the last abdominal segment is a pair of rounded caudal projections with six hairs each. The anal gills are four in number and prominent. The ventral gills, which appear at the first moult, are four in number; situated upon the eighth abdominal segment on the ventral surface. The anal prolegs bear three incomplete rows of dark bifid claws. The anterior prolegs are closely applied to each other and move as a single process; their tips are clothed with a mass of fine, curved pale hairs. (Plate IV, Fig. 19.)

*Pupa:* 5 to 9 mm. in length; bright red when newly transformed, changing to almost black. Respiratory processes of numerous fine

filaments in three main tufts upon each side of the thorax, filaments white turning to grey. Abdomen, usually partially enclosed in the old larval skin, bearing a pair of caudal fins from which issue a mass of long hairs; the eighth abdominal segment bears, laterally upon its apical edge, a pair of heavily chitinated spurs which are pentafid; abdominal segments 1 to 5 are marked laterally with a dash of dark pigment (Plate V, Figs. 27-29).

*Male*: 5.5 to 7 mm. Front of face pale, palpi 4 jointed, darker than face; antennæ 12 jointed, dark; the basal joint subglobular, large; the second joint twice as long as broad; joints 3 to 11 twice as wide or wider than long; the 12th joint longer than all others put together; all but basal joint plumose, hairs pale and unicolored. Eyes glabrous and black. Dorsum of thorax yellow with the usual three stripes, which in this species are cinereous brown with a grayish bloom; the middle stripe divided into two by a pale median line, the stripe is continued to the scutellum by a narrow dark line. Scutellum pale; metanotum and mesosternum brown. Wings finely punctate, venation as figured (Plate V, Fig. 25) not reaching beyond the sixth abdominal segment; veins yellow, cross vein brown. Coxæ yellow, legs greenish yellow and pilose; of all legs, tips of the femora, tibiæ and first, second and third tarsal joints dusky; fourth tarsal joint sometimes all dark, fifth tarsal joint always dark; claws distinct and black. Knees of fore legs dark and basal joint of tarsi having a relation of 52:36 with tibia; fore tarsal joints bare; tip of tibia lacking a comb. Tips of tibiæ of middle and hind legs bearing an incomplete comb with two of the teeth produced into sharp dark spurs. Abdomen with cinereous brown bands which lie at the base of the segment; each band is somewhat wider at the middle where it is prolonged into a fine line sometimes reaching the posterior margin of the segment; segments 1 to 5 pale on the venter; segments 6 and 7, cinereous markings continuous upon venter; 8 and 9 without markings all palely cinereous brown; segment 9 bearing apically a pale median hook; forceps of 3 pairs and as figured in Plate V, Figs. 32, 33, 34.

*Female*: 5.0 to 6.5 mm. Face and palpi as in male. Antennæ 6 jointed, yellow except apical joint which is brown; the basal joint subglobular; the second apparently a fusion of two as it bears two

rows of sensory pores the basal row of which is not possessed of sensory hairs, the outline of the segment is constricted but there is no evidence of a suture; segments 2 to 5 bottle shaped, the terminal joint as long as 3, 4 and 5 combined; all joints except basal have a single row of sensory hairs. Eyes glabrous. Thorax as in male. Wings finely punctate and reaching to middle of segment 8. Legs as in the male. Abdomen broad, segments with wide cinereous band covering all but a narrow posterior margin which is pale. Segments 1 and 2 pale on the venter; 3 to 7 marked all around, 8 and 9 palely cinereous; ovipositors of one pair, pale (Plate V, Figs. 35, 36, 37).

*Distribution:* New York, Illinois, Washington, Kansas, Idaho, South Dakota, and New Jersey.

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#### EXPLANATION OF PLATES III, IV AND V.

##### PLATE III.

- FIG. 1. Egg masses much enlarged.
- FIG. 2. Egg masses on grass, slightly enlarged.
- FIG. 3. Egg mass showing characteristic arcuate shape.
- FIG. 4. Larval tubes, natural size.
- FIG. 5. Egg masses on a stone, natural size.
- FIG. 6. A clump of larval tubes, natural size.

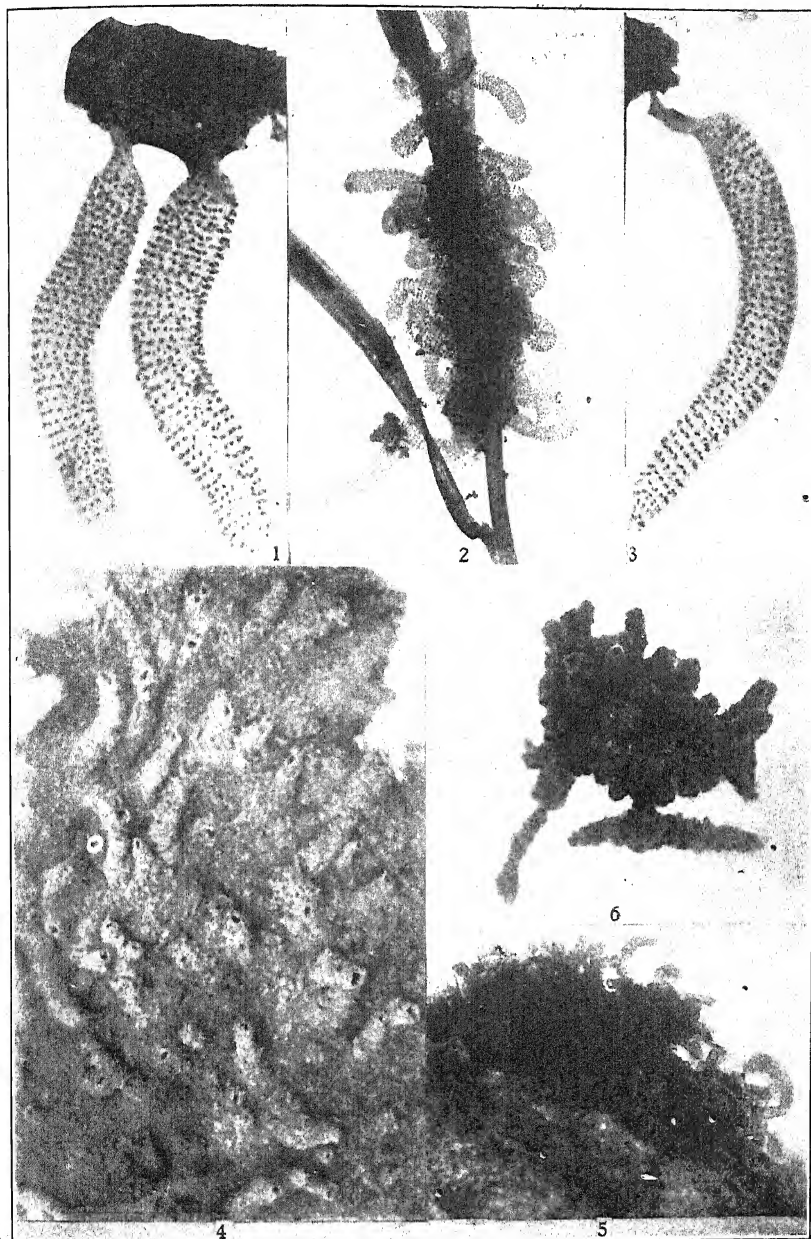
##### PLATE IV.

- FIG. 7. Labial border of full-grown larva, fourth instar. 330 X.
- FIG. 8. Labial border of larva of third instar. 575 X.
- FIG. 9. Labial border of larva of second instar. 1,150 X.
- FIG. 10. Labial border of larva of first instar. 1,700 X.

- FIG. 11. Mandible of full-grown larva with fourth tooth rounded. 220 X.  
FIG. 12. Mandible of full-grown larva with fourth tooth pointed. 220 X.  
FIG. 13. Bifid claw of the anal proleg. 300 X.  
FIG. 14. Antennæ of larva, dorsal view. 210 X.  
FIG. 15. Grown larva. 5 X.  
FIG. 16. Newly hatched larva. 80 X.  
FIG. 17. Last two abdominal segments of a larva of the second instar.  
45 X.  
FIG. 18. Last two abdominal segments of a larva of the third instar.  
25 X.  
FIG. 19. Larva one day old. 80 X.  
FIG. 20. Lateral view of head of full-grown larva. 50 X.  
FIG. 21. Dorsal view of head of full-grown larva. 50 X.  
FIG. 22. Last two abdominal segments of a full-grown larva. 15 X.

## PLATE V.

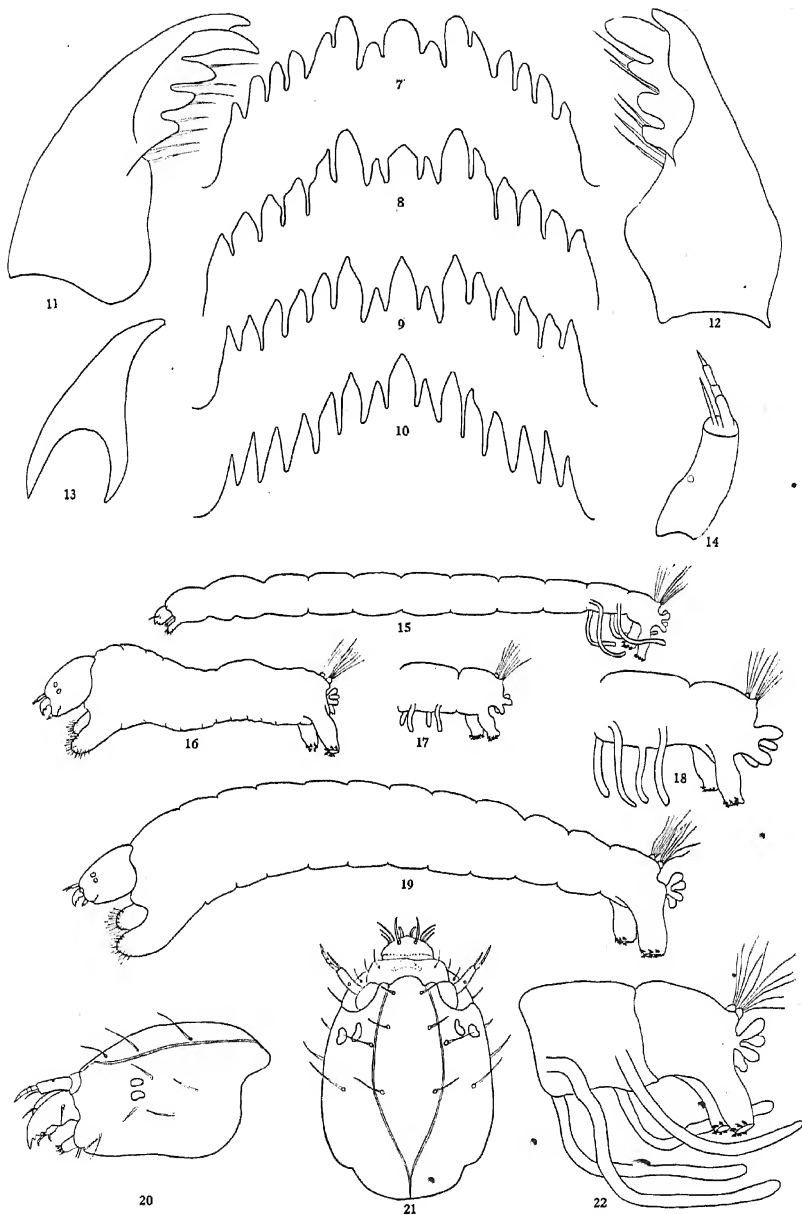
- FIG. 23. Antenna of female adult. 35 X.  
FIG. 24. Antenna of male adult. 25 X.  
FIG. 25. Dorsal view of male adult. 10 X.  
FIG. 26. Distal end of middle tibia to show comb. 100 X.  
FIG. 27. Lateral view of pupa with larval skin not completely shed.  
10 X.  
FIG. 28. Spur of eighth abdominal segment of pupa. 200 X.  
FIG. 29. Caudal fins of pupa. 25 X.  
FIG. 30. Egg mass. 15 X.  
FIG. 31. A single egg. 55 X.  
FIG. 32. Genitalia of male, lateral view. 60 X.  
FIG. 33. Genitalia of male, dorsal view.  
FIG. 34. Genitalia of male, ventral view.  
FIG. 35. Genitalia of female, ventral view. 55 X.  
FIG. 36. Genitalia of female, dorsal view.  
FIG. 37. Genitalia of female, lateral view.



CHIRONOMUS CRISTATUS, FABRICIUS

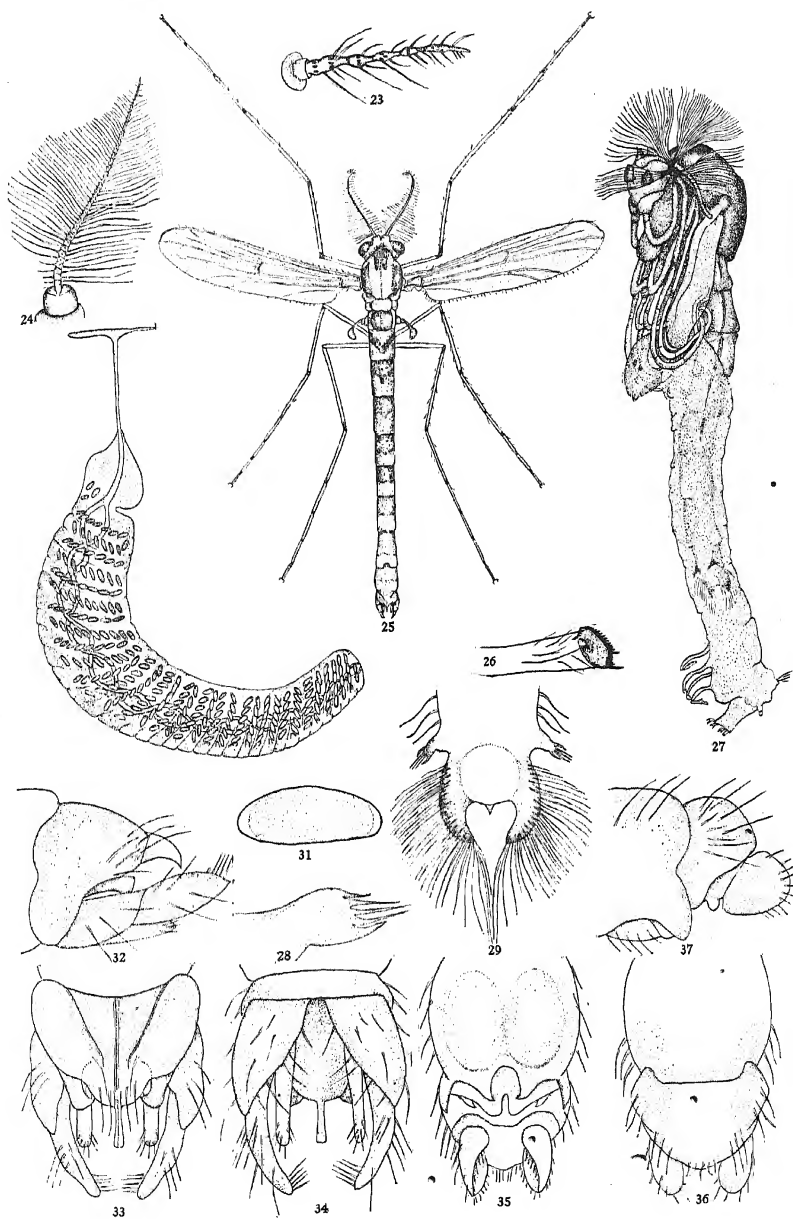






CHIRONOMUS CRISTATUS, FABRICIUS





CHIRONOMUS CRISTATUS, FABRICIUS



## MORPHOLOGY OF THE HEAD OF TRICHOPTEROUS LARVÆ AS A BASIS FOR THE REVISION OF THE FAMILY RELATIONSHIPS.<sup>1</sup>

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### INTRODUCTION.

The general and detailed anatomy of trichopterous larvæ has been thoroughly dealt with by several well-known investigators. A study of the sclerites of the head has led the author to a reconsideration of the phylogeny within the group, and the conclusions reached by him seem to warrant this addition to the literature.

The generally accepted classification of the Trichoptera gives as the stem form the family Rhyacophilidæ. The Hydroptilidæ or microtrichopterans are considered an early offshoot as are also the Philopotamidæ. In the same way the Psychomyidæ, Polycentropidæ and Hydropsychidæ possess certain relationships. These six families constitute a major subgroup. The remaining seven families make up a second subgroup. They are the Calomoceratidæ and Odontoceridæ; the Leptoceridæ and Molannidæ; the Phryganeidæ, Limnophilidæ and the Sericostomatidæ. The family relationships are as suggested here although the last family is made up of four subfamilies of somewhat doubtful affiliations.

The first subgroup has thysanuriform or campodeiform larvæ; the last group has eruciform larvæ. The outcome of the present study indicates that the stem form is to be found not in the campodeiform group, but rather in the eruciform group, namely the Leptoceridæ; and that the campodeiform is a specialized rather than a primitive condition among trichopterous larvæ.

### ACKNOWLEDGMENTS.

The present study had its origin in a problem undertaken at the suggestion of Dr. Cornelius Betten in 1913. The results were pub-

<sup>1</sup> Contributions from the Entomological Laboratories of the University of Illinois, No. 68. The publication of this paper has been made possible through an appropriation for plates by the University of Georgia, D. C. Barrow Chancellor.

lished at that time in the form of a key to Trichopterous larvæ (Krafka, 1915). The possibility of the relationships as herein indicated was first suggested to the author by Dr. Alex. D. MacGillivray, and the work has progressed under his direction.

The Illinois State Laboratory of Natural History has kindly loaned material some of which has proved exceptionally valuable. The greater part of the material comes from the private collection of Dr. Betten. The nature of my indebtedness to him is rather unusual. At his suggestion I first undertook the study of the trichopterous larvæ. These studies have led to conclusions seemingly opposed to his own. Yet his criticism has been generously given and he has lent assistance in every way possible to facilitate the successful outcome of the studies.

All heads described are figured. The explanation of the plates gives the source of the specimens.

#### CAMPODEIFORM AND ERUCIFORM LARVÆ.

1. *General Meaning and Significance:* The campodeiform (thysanuriform) and eruciform types of larvæ have been recognized in many orders of insects as respectively generalized and specialized in their organization. Folsom in his textbook of Entomology differentiates them as follows: "The former term is applied to many larvæ and nymphs on account of their resemblance to the Thysanura." "The resemblance lies chiefly in the flattened form, hard plates, long legs and antennæ, caudal cerci, well-developed mandibulate mouth-parts and active habits with the accompanying sensory specialization. These characteristics are permanent in Thysanura, but only temporary in metamorphic insects, and their occurrence in the latter forms may properly be taken to indicate that these insects have been derived from ancestors which were like Thysanura."

"These primitive characters are gradually overpowered in course of larval evolution, by secondary, or adaptive features.

"The prevalent type of larvæ among holometabolous insects is the eruciform, illustrated by a caterpillar or maggot. Here the body is cylindrical and often fleshy, the integument weak; the legs, antennæ, cerci and mouthparts reduced often to disappearance; the habits sedentary and the sense organs correspondingly reduced.

"The eruciform is clearly derived from the thysanuriform type as

Brauer and Packard have shown; the continuity of the two types being established by a complete series of intermediate stages."

2. *Occurrence in Trichoptera*: The two types of larvæ have long been recognized in the Trichoptera. The chief characteristics of each group may best be listed as opposites.

CAMPODEIFORM.

1. Long axis of the head continuous with long axis of the body.
2. Mouth directed cephalad.
3. Body depressed.
4. Legs long, generally all about same length.
5. Abdominal segments sharply constricted.
6. Prolegs long, slender, and movable.
7. Lateral line wanting.
8. Prosternal horn wanting.
9. Abdominal tubercles wanting.
10. Rectal blood gills generally present.
11. Free living, net builders, except Hydroptilidæ.

ERUCIFORM.

1. Long axis of the head at right angles with the long axis of the body.
2. Mouth directed ventrad.
3. Body cylindrical.
4. Front legs much shorter than other two pairs.
5. Abdominal segments faintly indicated.
6. Prolegs short, thick, and fixed.
7. Lateral line generally present.
8. Prosternal horn sometimes present.
9. Abdominal tubercles usually present.
10. Rectal blood gills wanting except in Leptoceridæ.
11. Building portable cases.

The characteristics peculiar to the campodeiform larvæ in the Trichoptera are those distinguishing the campodeiform larvæ of other orders of insects, while the same is true for the eruciform. Furthermore the various structures of the body may be arranged in an intergrading series consistent with the idea that the eruciform type is derived from the campodeiform.

This hypothesis is given additional support by the relationships as established among the adults. The Rhyacophilidæ have been taken as the stem form, since some members of this family retain the venation of the hypothetical wing type of Comstock. Furthermore those families which are placed nearest the Rhyacophilidæ on the basis of wing venation are characterized by campodeiform larvæ.

These three facts would seem to establish beyond a doubt the relationship within the order, at least as far as the two main groups are concerned.



## MORPHOLOGY OF THE HEAD.

1. *Methods of Study*: While the study of insect anatomy entails no special technique, it is well in an investigation of this type to give the principal steps in the method used.

The larvæ were preserved in 75 per cent. alcohol. They were not taken from their cases when collected. When ready for study, they were removed by pulling them out with a pair of forceps or by splitting the case. They were then dropped into boiling caustic potash to clear and soften. The abdomen was then snipped and the internal parts removed by pressure upon the chitinous parts. The heads were removed and studied separately, drawings being made of the dorsal, ventral and lateral aspects. The details were determined from specimens mounted in balsam. In most cases the whole dorsal and ventral aspects of the head were preserved by splitting the head along the lateral margin from the mandible to the occipital foramen. On one half, the fronto-clypeus, labrum and right mandible were thus held intact, while the gula, labium, maxillæ and left mandible were likewise preserved in position on the other half. Drawings were made with a compound microscope and a camera lucida. The magnification varies, as an attempt was made to have all the drawings of a uniform size.

2. *General Description of the Head*: The head capsule is an elliptical box with two large openings, the occipital foramen and the oral foramen. It is composed of three primary sclerites; a median cephalic fronto-clypeus, a vertex, and a median ventral gula (Plate VI, Figs. 1, 2, 3). The fronto-clypeus is a flat plate bounded on each side by the arms of the epicranial suture, while its cephalic margin is a long transverse border to which the membranous preclypeus is attached. The labrum is joined to the preclypeus. The caudal end of the fronto-clypeus is pointed, fitting into the angle formed by the arms of the epicranial suture. The lateral margins are either straight, regularly curved or sharply indented near their middle. These indentations mark the places of invagination of the pretentoria.

The vertex forms the greater part of the head capsule; it is separated on the dorsal aspect of the head by the fronto-clypeus and on the caudal aspect to the occipital foramen by the stem of the epicranial suture. The vertex extends laterad and ventrad to form the

lateral and the greater part of the ventral aspect of the head. In some forms the vertex is contiguous for the greater part of its length on the ventral aspect, being separated only by the gular suture. In other forms, however, it is widely separated by the gula itself (Plate VIII, Fig. 43). In this case the gula extends from the occipital foramen to the proximal end of the labium, but in the former case it is restricted to a small triangle adjacent to the labium. In the first case the vertex alone surrounds the occipital foramen. In the latter case the gula and vertex together bound it. The vertex bears the eyes and the antennæ. The labrum is a subelliptical sclerite which serves as an upper lip. It is generally notched on its free margin. The pre-clypeus which attaches it to the fronto-clypeus is inserted a short distance cephalad of the posterior edge. The ventral aspect is generally membranous, heavily bristled and continued caudad as the epipharynx.

3. *Mouth-parts*: The mandibles are roughly pyramidal or pyriform. The articulations are of the acetabulum-condyle type. The dorsal articulation has the acetabulum on the mandible and the condyle on the vertex, while in the ventral one the conditions are reversed (Plate VI, Fig. 2). Movements of the mandibles are effected by two tendons which swing them on their articulations like a gate. Flat scissors-shaped and thick chisel-shaped mandibles occur. Their inner surfaces are either toothed for grasping or hollowed out for crushing. The inner basal margins are attached to the lateral membranes of the mouth.

The labium and maxillæ are united and together form an under lip. The labium is median in position and has its basal attachment on the cephalic margin of the gula. Its shape is more or less triangular, broad at the base and terminating in the hemispherical segment, the fused stipulæ. This terminal segment bears a pair of one or two segmented labial palpi, while at its tips, the fused glossæ, is the single opening for the salivary glands.

The maxillæ are generally about the same length as the labium. The basal attachment is by means of the chitinous cardo. The stipes is a small flexible, subcylindrical segment with its mesal margin fusing with the lateral margin of the submentum. Its basal and lateral margins are attached to the cardo, vertex and the inner basal membranes of the mandibles. The stipes is supported by a chitinous cuff

that nearly surrounds it. The stipes itself is not capable of much independent movement, but together with the labium, the lower lip moves freely. The terminus of the maxilla is generally composed of two parts, the galea and the maxillary palpus. In some cases they are fused along their adjoining faces to form a single flexible projection which is heavily armored with bristles and supplied with numerous sense organs. The maxillary palpi are either four or five segmented. The segments of these palps are usually not completely chitinized; the chitinization being in the form of a cuff and leaving the mesal surface open to movement. The proximal segment of the maxillary palpus is generally indistinguishable from the proximal end of the galea except for the cuff.

The membranous glossæ are continuous with the parapharynx. The lateral boundaries of the labium are not clearly separated from the maxillæ, especially in the cases where chitinization is slight. The mentum and submentum are likewise not distinguishable. The submentum however generally bears a single large median plate or a pair of small plates.

The eyes generally consist of six simple, closely adjacent, ocelli, placed on a pigmented eye-spot. These eyes are slightly elevated. Their position on the vertex varies from a point near the laterocephalic margins of the head to a point as far caudad as the separation of the epicranial arms.

The antennæ are simple. *Siltala* recognizes two types: one with two distal pieces, the other with only one. Their position varies with that of the eyes from immediately behind the mandibles to a point far up on the head.

4. *Internal Skeleton*: The endoskeleton of the head is greatly reduced. The tentoria consist of a single pair of flexible fiber-like arms extending through the head from the dorsal to the ventral wall. The dorsal invaginations are found in the indentations of the epicranial arms, while the ventral invaginations are located in the angles formed by the gula and the vertex in the open type and near the caudal ends of the gular suture in the closed type. The supratentoria and corpotentoria are not present in the late larval stages, although I found a single corpotentorium in an early instar of *Mystrophora americanum*.

The above general description is well illustrated by the Phryganeid in Plate VI, Figs. 1, 2, 3 and 4. While there is considerable variation in the structure and arrangement of the various sclerites and appendages, there is a remarkable consistency in the occurrence of the described parts, and in no family are the deviations so marked that the sclerites may not be readily identified.

#### COMPARATIVE STUDY OF HEAD.

1. *Fronto-clypeus*: This shield-shaped sclerite presents a fascinating study in its variation, for here Nature has escutcheoned the genealogy of the order. The simplest type is found in the straight-sided, roughly pentagonal, head piece of Leptocerid 26720 (Plate VI, Fig. 5). From this simple type three principal changes are evident: (1) the rounding of the pointed end; (2) the flaring at the cephalic margins; (3) the indentations of the lateral margins in association with the pretentoria. These three changes may follow a primary tendency to widen the fronto-clypeus, the resultant ornate character of the epicranial arms being due to the anchoring effect of the pretentoria.

Leptocerid I and Leptocerid III illustrate the initiation of these changes (Plate VI, Figs. 6 and 7), while *Leptocella uwarowii* and *Mystacides sepulchralis* show them emphasized still further (Plate VI, Fig. 9). An unusual development of the cephalic margin is characteristic of Leptocerid II (Plate VI, Fig. 8).

The Molannidæ approximate the Leptoceridæ in the shape of the fronto-clypeus. Except for the anterior margin, which is regularly bowed, *Molanna cinerea* (Plate VI, Fig. 10) is a duplicate of *L. uwarowii*. *Molanna* II is a change in the same direction although marked by a chitinous ridge near the cephalic margin (Plate VI, Fig. 11).

The Phryganeidæ specialize in the development of the cephalic flares of the epicranial arms. The arms curve outward sharply as they approach the clypeal suture until they are nearly parallel with it. Then with a right angle bend they meet the latter, forming a small, squarish, projecting corner (Plate VI, Fig. 1).

The type of fronto-clypeus developed in the Phryganeidæ persists with little modification in the remaining families of eruciform larvæ. It is repeated almost to identity in the Calamoceratidæ, Limnophilidæ, and Sericostomatidæ (Plate VI, Figs., 12-18). The ex-

pected exceptions are presented in the Odontoceridæ and in a few genera of the sub-family Brachycentrinæ.

The Odontoceridæ lack the small squarish latero-cephalic corners; the epicranial arms proceeding directly to the clypeal suture without bending outward. The same conditions are found in the Brachycentrinæ mentioned above. The evidence that these two similar conditions were brought about in different ways will be presented in the discussion of the chætotaxy of the head.

It is with interest that we find the same developmental tendencies in the campodeiform and the eruciform groups. The Hydroptilidæ (Plate VII, Fig. 19) very closely resemble the Leptoceridæ, while the Rhyacophilidæ approximate the phryganeid pattern, although in the latter the cephalic part of the sclerite is markedly shorter (Plate VII, Fig. 38).

The Philopotamidæ and the Polycentropidæ show approximately the same type of fronto-clypeus as the Phryganeidæ, except for the cephalic flares. The Philopotamidæ are peculiar in that the cephalic margin of this sclerite is asymmetrically notched (Plate VII, Fig. 23).

The subfamily Glossosomatinae depart from the phryganeid pattern in that the epicranial arms take a concave rather than a convex course from the pretentoria to the clypeal suture. This tendency is repeated again in a few hydropsychids and may possibly suggest a relationship.

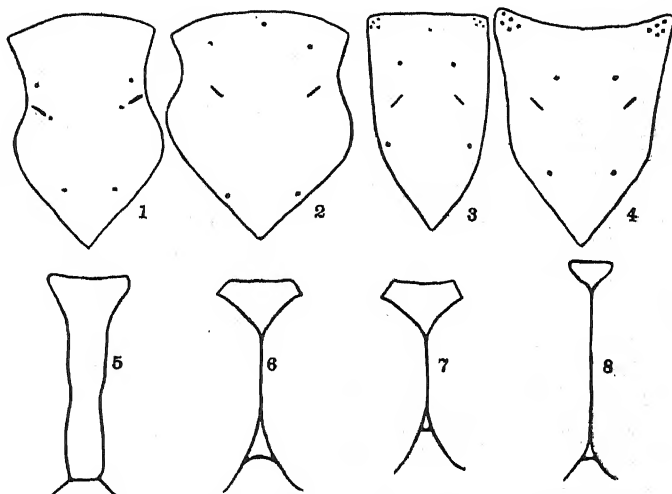
The Hydropsychidæ of the Eastern United States examined by the author showed a fronto-clypeus which is strikingly different from any other in the order and for a time presented a discontinuous example in an otherwise orderly array. It is roughly triangular and apparently bore no relation to the other types. Through material obtained at Tolon, Colorado, and Soda Butte, Montana, the successive steps in the development of this odd form were made out.

In *Hydropsyche* 27006, the fronto-clypeus is shield-shaped. The lateral margins are formed by a double curve of the epicranial arms, which at first diverge widely, then with a slight curve converge again to points marked by the pretentorinæ. A short outward curve carries them to the convex cephalic margin (text figure 1).

*Hydropsyche* 27256 has a broader and a longer apex. The epi-

cranial arms do not converge to the degree exhibited by 27006. The resulting sclerite is broad and shield shaped (text figure 2).

In *Hydropsyche incommoda*, the epicranial arms are nearly straight (text figure 3), forming a roughly triangular sclerite which is characteristic of nearly all Hydropsychidæ and the Macronematinae (text figure 4).



TEXT-FIGURE. 1. Fronto-clypeus of *Hydropsyche* 27006 Ill. St. Lab. Nat. Hist. 2. Fronto-clypeus of *Hydropsyche* 27256 Ill. St. Lab. Nat. Hist. 3. Fronto-clypeus of *Hydropsyche incommoda*. 4. Fronto-clypeus of *Macronema zebratum*. 5. Gula of *Hydropsyche* 27006 Ill. St. Lab. Nat. Hist. 6. Gula of *Hydropsyche* 27256 Ill. St. Lab. Nat. Hist. 7. Gula of *Hydropsyche incommoda*. 8. Gula of *Macronema zebratum*.

Series to demonstrate the simultaneous and correlated development of the dorsal and ventral aspects of the head in the Family Hydropsychidæ.

The three stages given here present a consistent series connecting the aberrant hydropsychid pattern with that of the phryganeid. They indicate the broadening of the sclerite by the shifting of the epicranial arms.

That such a shift has actually taken place is supported by the evidence of the pretentorinæ. In all forms of trichopteran larvæ, except the Hydropsychidæ, the invagination marking the internal skeleton is directly associated with the epicranial arms. In one Mo-

lannid the invaginations form a deep depression that lies along the suture (Plate VI, Fig. 11). In *Hydropsyche* 27006 the pretentorinæ are slightly removed from the epicranial arms. In *Hydropsyche* 27256 they are still further removed. In most of the Hydropsychidæ they are displaced to such a distance that one would no longer associate them with the arms.

Thus while the pretentorinæ have retained their original position on the head, the epicranial arms have moved out and away from them, doubtless due to the tendency to broaden the head. In all forms but the Hydropsychidæ, the pretentorinæ have acted as anchoring points and have given the arms their sinuous character. In the Hydropsychidæ the arms have freed themselves and have left the pretentorinæ isolated. We may thus fix the hydropsychid pattern in the phryganeid series.

2. *Chatotaxy of Fronto-clypeus*: A very interesting set of relationships appear with the study of the bristles of the fronto-clypeus. The Leptoceridæ with the straight-sided fronto-clypeus possess only three pairs of bristles (Plate VII, Fig. 28). The first pair, I, are just caudad of the pretentorinæ. The second pair, II, are immediately cephalad, while the third pair, III, are still further removed from the pretentorinæ. The majority of Leptoceridæ have an additional fourth pair, IV, near the cephalo-lateral angles, and a fifth pair, V, slightly laterad to these (*Mystacides sepulchralis*, Leptocerid I, Leptocerid II, Leptocerid III, Leptocerid 13839). *Leptocella wwarowii* presents an additional sixth, VI, between IV and V (Plate VII, Fig. 29).

The Molannidæ show the same three pairs of lateral bristles but with four pairs on the cephalic margin instead of two (Plate VII, Fig. 30). These seven pairs are again present in the Phryganeidæ and the pattern here assumed is repeated with surprising uniformity in the remainder of the eruciform larvæ (Plate VII, Figs. 31-36).

The single median pit is also a noticeable feature of all the eruciform group, with the exception of the Leptoceridæ. This structure has the appearance of a calyx, but I have never found a seta attached at this point.

The few exceptions to typical chatotaxy occur in those forms in which the fronto-clypeus is also exceptional. *Brachycentrus*, lacking the cephalic flares, has only two pairs of bristles on the cephalic

margin. The central pit is also absent. This condition suggests relationship with the Leptoceridæ and is further supported by the evidence of the gula. The other exception is *Psilotreta* where but three cephalic pairs were found instead of the typical four (Plate VII, Fig. 35). A fourth pair however were discovered on the vertex in close proximity to the cephalo-lateral corners. The fronto-clypeus in this form is slightly different from the rest of the higher eruciform larvæ. The epicranial sutures proceed directly to the cephalic margins without the little bends that produce the small squarish corners in the sclerite. Were these present they would include this fourth pair of setæ. In no other form of the eruciform larvæ are there any setæ present on the vertex in close proximity to the clypeus at its anterior margin. The fourth pair then in *Psilotreta* is probably represented by this pair displaced on the vertex, and suggests a shift from the phryganeid pattern.

The exact position of the seven pairs of setæ may vary slightly in the several eruciform families or even within a genus, but the general relationship is practically constant.

In the campodeiform group, the same general pattern is present but with a greater diversity in number and arrangement of the setæ. Hydroptilid II shows a clypeus similar in chaetotaxy to that of the Leptoceridæ (Plate VII, Fig. 37). In the remaining families some interesting modifications are to be found.

The Rhyacophilidæ show a peculiar tendency to double the bristles I, II, III. Instead of a single bristle as in *Mystrophora americana* there are two (Plate VIII, Fig. 43), one lying directly mesad of the other. Instead of II in its usual place near the pretentorinæ (P), a pair of setæ is found on either side. At a first glance, III is absent; or possibly one of the pair in the normal position of II may be III. The interpretation is best given after reference to conditions in closely related material. Setæ IV, V, VI, and VII are in their normal position in the latero-cephalic corners.

*Rhyacophila fuscula* (Plate VII, Fig. 38): shows a pair of setæ on each side in place of I. Their arrangement, however, is anterior-posterior instead of lateral as in *Mystrophora*. Here again as in *Mystrophora*, we find a pair of setæ where II should be. Seta III is present in its normal position so that the interpretation of the pair is clear.



Setæ IV, V, and VII are in their normal position. VI is found on the vertex as in *Psilotreta*.

Returning to *Mystrophora americana* again, the explanation of the pair of setæ at II is suggested by the condition in *R. fuscula*. A consideration of the shape of the fronto-clypeus in *M. americana* makes this explanation more certain. The lateral margin of this sclerite is concave on the cephalic half and convex on the caudal half. In the majority of Trichoptera the margin is concave on both halves. An examination of the vertex in the proximity of where III should be, brought to light a pair of setæ that would have the position of III if the clypeus were of the normal type.

Other representatives of the Glossosomatinae and the Rhyacophilinae show a similar doubling of setæ I, II, and III.

In the Polycentropidæ a somewhat similar condition is met. Seta I is single and varies in position from near the apex in Polycentropid 13942 (Plate VII, Fig. 40) to a point near the pretentorina in *Phylocentropus* sp.? (Plate VII, Fig. 41). Seta II is double and situated about half way between the pretentorina and the cephalic margin. In Polycentropid I, one of the members of the pair is mesad and cephalad to the other. In *Phylocentropus* the one is so far removed from the other that it is nearer III than it is to its fellow.

In *Polycentropus* I (Plate VII, Fig. 21), seta VII is in the corner, while setæ, V, VI and IV form a small triangle half way between the corner and the median line. In *Phylocentropus* setæ VII, V, and VI are in a straight line with IV slightly cephalad.

The chaetotaxy of the Philopotamidæ is even more complicated. Seta I is single and located far caudad, while seta II is double. In Philopotamid 26993 (Plate VII, Fig. 23), one member of the pair is directly mesad to the other, forming a straight line across the clypeus. In *Chimarrha* sp? (Plate VII, Fig. 39) one member of the pair is situated directly cephalad of the other, forming a polygon. Seta III is situated far cephalad, is single and is associated with setæ VII, V, VI, and IV. In the last-named species it assumes a position in the latero-cephalic corners, while the four remaining setæ are grouped on an asymmetrical projection in the cephalic margin. Other Philopotamidæ present various similar arrangements. In several species where the clypeus is extremely asymmetrical, the median calyx is wanting.

In the Hydropsychidæ, the setal arrangement is obscured by the presence of a large number of secondary setæ. Setæ I and II alone are distinguishable.

It is thus apparent from a study of the fronto-clypeus that while variation occurs in shape and chaetotaxy, they may all be referred to a common type. This plan has its simplest expression in the Leptoceridæ. The eruciform and campodeiform groups can readily be distinguished from one another by their own peculiarities. The eruciform larvæ tend to perfect the phryganeid pattern in both shape and chaetotaxy. The campodeiform larvæ lack the regularity of the eruciform larvæ and individual patterns are developed in the separate families.

3. *Gula*: This sclerite gives an even more instructive series than the one previously discussed, for in the family Hydropsychidæ we find evidence that is indisputable in its confirmation of the new genealogy. In many other families are found straggling remnants of this piece, clearly marking the phylogenetic trail.

I have applied the terms open and closed gula respectively to those cases where the gula reaches the occipital foramen; and where the two parts of the vertex are contiguous preventing the gula from reaching the occipital foramen (Plate VIII, Figs. 44 and 49).

The Leptoceridæ show the greatest development of the open type. In Leptocerid II, the gula is a short broad plate that widely separates the vertex (Plate VIII, Fig. 47). In *Leptocella uwarowii* it is a triangular piece (Plate VIII, Fig. 46), while in *Mystacides* it is a large and quadrilateral area (Plate VIII, Fig. 45). In the *Æcitinæ* it has the appearance of being overdeveloped. Thus in Leptocerid I it is more than half the width of the head. It is roughly elliptical in shape, while the vertex has a tendency to enclose it (Plate VIII, Fig. 44). The same is true in Leptocerid 11561, except that the shape is quadrilateral, while in Leptocerid 26720 it is sub-crescentic (Plate VIII, Fig. 43).

The gula of the Molannidæ is very much like that of *Mystacides*. They are roughly quadrilateral and distinctly of the open type (Plate VIII, Fig. 48).

The Phryganeidæ show a transition from the open to the closed type. Phryganeid II has an open gula. It is long, narrow, and straight at the cephalic end and roundly pointed at the caudal end.

While the vertex almost encloses the gula, it does not meet behind it. But in *Neuronia postica*, the same style of gula is completely enclosed (Plate VI, Fig. 3).

Other intermediate stages from an open to a closed gula are to be found in the Calamoceratidæ. In *Ganeonema americanum* the main part of the gula is restricted to an enclosed triangle but its strongly pointed end fills the gular suture for nearly its entire length (Plate VIII, Fig. 49).

Similar transitional stages are found in the family Limnophilidæ. *Neophylax* sp. has an open T-shaped gula (Plate VIII, Fig. 50). The vertex almost encloses it but does not meet behind it. In Limnophilid 13277 a gula similar to that of *Ganeonema* is present (Plate VIII, Fig. 51). For a further reduction of the gula, the remaining figures of the Limnophilidæ and the Odontoceridæ should be compared. The extreme condition is represented by *Helicopsyche* and *Psilotreta* (Plate VIII, Figs. 52-55).

Another series of a more striking type is found in the family Sericostomatidæ. The subfamily Brachycentrinæ has a widely open gula (Plate VIII, Fig. 57), the Lepidostomatinae show a peculiar transitional type, while the gula is enclosed, the vertex fails to meet behind it, and a pair of pseudo-sutures follow those between the gula and the pleuræ on either side (Plate VIII, Fig. 59). The Gœrinæ have a small triangular enclosed gula which is but slightly removed from the occipital foramen (Plate VIII, Figs. 56 and 58).

Most descriptions of the campodeiform larvæ limit the gula to a small triangular sclerite at the proximal end of the labium, or in some cases indicate the complete absence of the gula. The present study shows definitely the limits of the gula and the steps by which it has been restricted.

The Hydroptilidæ have a short broad gula at the proximal end of the labium. It is roughly triangular or keel-shaped. There is also a small triangular sclerite at the end of the gular suture in the angle formed by the junction of the two parts of the vertex. The importance of this small sclerite will become apparent in the discussion of the Hydropsychidæ (Plate IX, Fig. 60).

The gula of the Glossomatinae (*Mystrophora*) is a sclerite similar in shape to that of the Hydroptilidæ. That of the Rhyacophilinae is

rather large and pentagonal. A very small area of cuticle is noticeable at the end of the gular suture in every specimen examined (Plate IX, Fig. 61).

The Polycentropidæ and Philopotamidæ are similar in having a broad, short, triangular gula (Plate IX, Figs. 62 and 63).

Most of the Hydropsychidæ have a gula shaped like that of the Rhyacophilidæ. This family of Trichoptera furnishes the material for the interpretation of the gular reduction. *Hydropsyche* 27006 has a gula which reaches from the labium to the occipital foramen. It is rather broad, with sides nearly straight and parallel, but diverging at the cephalic ends into a wide flare (text fig. 5 and Plate IX, Fig. 65).

*Hydropsyche* 27256 has a gula consisting of two pieces, such as would be formed from one like 27006 if the vertex came together near its middle, thus cutting it into a cephalic and a caudal half (text fig. 6 and Plate IX, Fig. 66).

*Hydropsyche incommoda* has a gula which is irregularly pentagonal. At the base of the gular suture is a minute area which represents all that is left of the caudal piece (text fig. 7 and Plate IX, Fig. 67). *Macronema* has a similar piece wedged into the gular suture, while its cephalic part is further reduced to a small triangular piece (text fig. 8 and Plate IX, Fig. 68).

These three steps in the reduction of the gula alone would indicate the direction of evolution within the order. For it is hardly conceivable that the open type could originate through the spontaneous appearance and the gradual enlargement of the sclerite at the base of the gular suture; that this sclerite could fuse with the enclosed triangular piece already present and that the two together form the broad open type.

Furthermore, the development of the ventral and dorsal aspects of the head are fully correlated. When the data already presented on the fronto-clypeus is compared with that of the gula, we find a complete corroboration.

*Hydropsyche* 27006 has a long open gula; dorsally the pretentorinæ are only slightly removed from the epicranial arms. *Hydropsyche* 27256 has a two-piece gula; the pretentorinæ are further removed. *Hydropsyche incommoda* has only a trace of the caudal piece of the

gula left; the pretentorinæ are no longer associated with the epicranial arms. Thus the modifications of the two sides of the head seem to have been simultaneous and orthogenetic in character.

The small piece wedged into the gular suture in some of the Hydroptilidæ and the Rhyacophilidæ suggests a similar development. The caudal ends in the higher eruciform larvæ also support development from the open type.

Additional evidence could be brought forward in the consideration of the metatentorinæ. In the open type they are always found at the edges of the vertex in the angle formed by the latter and the gula. In the closed type, they are always found at the occipital end of the gular suture, thus furnishing landmarks for the homology of the various structures.

4. *Structure and Position of the Antennæ*: Siltala recognizes two types: one, with a distal segment upon which are mounted two separate so-called palps, and numerous sense bristles; the other with but a single so-called palp. The first form is stated to be common to the campodeiform group, while the second is peculiar to the eruciform group. I have found no trace of antennæ in the Rhyacophilinæ, Philopotamidæ, Polycentropidæ and the Hydropsychidæ.

The antennæ of the Hydroptilidæ are very similar to those of the Leptoceridæ, long, cylindrical and slender, with the palp set on a raised base slightly behind the dorsal mandibular articulation. Exceptionally long antennæ are found in the *Æcetinæ*, in *Mystacides* and in *Leptocella*. The Molannidæ present the same type and location in antennæ.

In the Phryganeidæ, the antennæ are reduced in size, particularly with respect to the terminal segment. Their position is near the base of the mandibles, but in a more lateral position and separated from the pleural condyle by a pseudo-suture. In the Calamoceratidæ, the antennæ are of the phryganeid type, but are completely removed from the cephalic margin to a position half way up on the head. The Limnophylidæ show the same structure and position of the antennæ.

With respect to this character the Sericostomatidæ show again an interesting developmental series. In the Brachycentrinæ the antennæ are at the cephalic margin; in the Lepidostomatina they are halfway between the mandibles and the eyes.

The antennæ are important structures in the consideration of family relationships and receive the best interpretation when we consider the Leptoceridæ as the stem form. Otherwise it is difficult to account for the fact that they are well developed in the Hydroptilidæ, lost in one subfamily of the Rhyacophilidæ, and the other families of the campodeiform group, present again in the Leptoceridæ with greatest functional development, and then consistently reduced in size and migrating up the sides of the head in the remaining eruciform larvæ.

#### CONCLUSIONS.

The foregoing pages give a fairly comprehensive description of the head of the trichopterous larvæ. While much detail could be added, those characters of primary importance have been examined and discussed. Before going into the anatomy of the thorax and abdomen, it might be well to sum up the data concerning the head to see if anything like order exists in the relationship of the various parts among the respective families.

The sclerite showing the greatest variation in form is the gula. The two types are the open and the closed. The open type is found primarily in the eruciform group and has its greatest development in the family Leptoceridæ. A graded series of forms is found within the eruciform families which leads from the open to the closed type. The successive steps are from the Leptoceridæ to the Molannidæ, Phryganeidæ, Calomoceratidæ, Limnophilidæ, and the Odontoceridæ. The Sericostomatidæ show a like series within the subfamilies, ranging from an open gula in the Brachycentrinæ to a partially closed one in the Lepidostomatinae, to a closed one in the Gœrinæ. The closed type is clearly derived from the open. The vertex has come together behind the gula and enclosed it. In some cases the straggling caudal end is still to be seen in the gular suture.

The campodeiform larvæ show, with but few exceptions, the extreme closed type. The method of development of this type is clearly shown in the Hydropsychidæ, where an open gula, a gula constricted into two equal pieces, and a gula constricted into a cephalic part and a minute caudal piece have been demonstrated.

The closed gula of the campodeiform larva is thus brought about by the constriction of the open type into two pieces with the subsequent reduction and disappearance of the caudal piece.

The relationship on the basis of gula would indicate the Leptoceridæ as the stem form, with the higher eruciform larvæ diverging in one direction through the enclosure of the gula by confinement, while the campodeiform larvæ vary in the same direction in the enclosure of the gula by constriction.

A consideration of the fronto-clypeus lends corroborative evidence to the new arrangement of the families of Trichoptera. The straight-sided simpler types are found in the Leptoceridæ. With the pretentorinæ as anchoring points the epicranial arms have bowed above and below to form a sclerite of graceful contour. The development of the various forms is through the Molannidæ, Phryganeidæ to the Limnophilidæ respectively, thus bearing out the family relationships as established for the gula.

The only family in which the epicranial arms have left the pretentorinæ is the Hydropsychidæ. And in this case we find a very definite correlation between the development of the fronto-clypeus and the gula. In the hydropsychid with the open gula, the pretentorinæ are only slightly removed from the epicranial arms; in the species with the gula constricted into two equal halves the pretentorinæ are further removed from the epicranial arms; in the majority of hydropsychids, where the pretentorinæ would not be associated with the epicranial arms, the gula is restricted to a very small triangular piece at the cephalic end of the gular suture.

The chaetotaxy of the fronto-clypeus indicates by itself the same general arrangement as that established for the shape of this sclerite and the shape of the gula.

While the labrum shows nothing so definite in its development as do the fronto-clypeus and gula, yet all the positive evidence would favor the new arrangement. It is in the higher campodeiform larvæ that the most highly specialized, asymmetrical labra exist.

The mandibles also have undergone little change. Two types, however, are distinct. The thin, flat, knife-shaped type is characteristic of the Leptoceridæ, Molannidæ, Phryganeidæ and most of the campodeiform larvæ. The thick, blunt, chisel-shaped type is found in the eruciform larvæ.

The labium, while it has undergone little change in special development, shows a consistent and verifying plan in the chitinization

of the submentum. The two bristles, constantly present, leave no doubt as to the identity of the plate. From a condition of no chitination in the Leptoceridæ to one in which small plates are laid down at the base of the setæ in the higher eruciform, further chitination produces a large single median plate in the campodeiform larvæ. This reaches its highest development in the bilobed plate in the Hydropsychidæ.

The maxillæ, while giving little in the way of positive evidence, present no difficulties for the new arrangement of trichopterous genealogy. The maxillary palpi are five-segmented throughout with the exception of the Leptoceridæ. The latter, together with the campodeiform larvæ, possess long slender, flexible, maxillary palpi, while those of the eruciform larvæ are short, blunt and heavily chitinated.

The position of the eye supports the new arrangement. The eyes are far cephalad in the Leptoceridæ. The movement in the eruciform larvæ is away from, while in the campodeiform larvæ it is towards, the cephalic margin of the head. This is doubtless correlated with the respective attitudes of the head in the two groups.

The position of the antennæ lends further evidence of the same kind. In the Leptoceridæ they are in a cephalic position, gradually retreating caudad on the head, a movement doubtless correlated with the migration of the eyes in the higher eruciform larvæ. When present in the campodeiform larvæ they are far cephalad. The position of the antennæ becomes of primary importance when their origin is considered. They arise as appendages of the premandibular segment. In their embryological development, the earlier stages are adjacent to the bases of the mandibles. This would indicate a generalized condition, while that away from the mandible would be specialized. The embryological studies of Patten on *Neophylax*, a Limnophilid, show the migration of the antennæ from a cephalic to a lateral position.

All these data taken together favor the assumption that the Leptoceridæ are the stem form, with two principal lines of development, the eruciform and the campodeiform types. The Hydroptilidæ are a very early offshoot and not directly related to the campodeiform type with which they are ordinarily associated.

If this hypothesis be correct, we should expect to find some degree



of correlation in the development of the structures of the thorax and the abdomen. This study has been made and the author hopes to publish the results in a subsequent paper.

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## EXPLANATION OF PLATES.

## PLATE VI.

FIG. 1. *Neuronia postica*, dorsal aspect of the head. *L*, labrum; *Md*, mandible; *LM*, labral membrane; *FC*, fronto-clypeus; *Pl*, vertex; *EA*, epicranial arms; *Pt*, pretentorina; *E*, eye; *A*, antennæ.

FIG. 2. *Neuronia postica*, lateral aspect of head. *Pl*, vertex; *T*, tentorium; *Mx*, maxilla; *Li*, labium.

FIG. 3. *Neuronia postica*, ventral aspect of the head. *Pl*, vertex; *OF*, occipital foramen; *M*, metatentorina; *G*, gula; *Li*, labium.

FIG. 4. *Neuronia postica*, ventral aspect of the labium and maxilla. *G*, gula; *Sm*, sub-mentum; *M*, mentum; *Gl*, glossæ; *Pl*, labial palpus; *C*, cardo; *S*, stipes; *La*, lacina; *PM*, maxillary palpus.

FIG. 5. Leptocerid 26720 (Ill. St. Lab.). Dorsal aspect of head.

FIG. 6. Leptocerid I (Cold Spring Harbor). Dorsal aspect of head.

FIG. 7. Leptocerid III (Cold Spring Harbor). Dorsal aspect of head.

FIG. 8. Leptocerid II (Cold Spring Harbor). Dorsal aspect of head.

FIG. 9. *Mystacides sepulchralis* Walk. Dorsal aspect of head.

FIG. 10. *Molanna cinerea* Hag. Dorsal aspect of head.

FIG. 11. *Molanna* II (Cold Spring Harbor). Dorsal aspect of head.

FIG. 12. *Ganonema americanum* Walk. Dorsal aspect of head.

FIG. 13. *Stenophylax luculentus*. Dorsal aspect of head.

FIG. 14. *Neophylax* sp. Dorsal aspect of head.

FIG. 15. *Psilotreta frontalis* Banks. Dorsal aspect of head.

FIG. 16. Lepidostomatid I (Cold Spring Harbor). Dorsal aspect of head.

FIG. 17. *Gara* sp.? Dorsal aspect of head.

FIG. 18. *Brachycentrus nigrisoma* Banks. Dorsal aspect of head.

## PLATE VII.

FIG. 19. Hydroptilid II (Cold Spring Harbor, N. Y.). Dorsal aspect of the head.

FIG. 20. *Rhyacophila fuscata* Walk.

- FIG. 21. *Polycentropid* I (Cold Spring Harbor).  
FIG. 22. *Phylocentropus* sp.  
FIG. 23. Philopotamid 26993 (Ill. St. Lab.).  
FIG. 24. Hydropsychid 27006 (Ill. St. Lab.).  
FIG. 25. Hydropsychid 27256 (Ill. St. Lab.).  
FIG. 26. *Macronema zebratum* Hag.  
FIG. 27. *Hydropsyche incommoda*.  
FIG. 28. Leptocerid 29451 (Ill. St. Lab.). Enlarged view of the frontoclypeus to show the details of chaetotaxy.  
FIG. 29. *Leptocella uwarowii* Kol.  
FIG. 30. *Molanna cinerea* Hag.  
FIG. 31. Phryganid sp.  
FIG. 32. *Ganonema americanum* Walk.  
FIG. 33. Lepidostomatid I (Cold Spring Harbor).  
FIG. 34. *Anabolia* sp.  
FIG. 35. *Psilotreta frontalis* Banks.  
FIG. 36. *Brachycentrus* sp. (Cold Spring Harbor).  
FIG. 37. Hydroptilid II (Cold Spring Harbor).  
FIG. 38. *Rhyacophila fuscula* Walk.  
FIG. 39. *Chimarra* sp. Ithaca.  
FIG. 40. *Polycentropid* 13942 (Ill. St. Lab.).  
FIG. 41. *Phylocentropus* sp.  
FIG. 42. *Mystrophora americana* Banks.

## PLATE VIII.

- FIG. 43. Leptocerid 11561 (Ill. St. Lab.). Ventral aspect of the head.  
FIG. 44. Leptocerid I (Cold Spring Harbor).  
FIG. 45. *Mystacides sepulchralis* Walk.  
FIG. 46. *Leptocella uwarowii* Kol.  
FIG. 47. Leptocerid II (Cold Spring Harbor).  
FIG. 48. *Molanna cinerea* Hagen.  
FIG. 49. *Ganonema americanum* Walk.  
FIG. 50. *Neophylax* sp.  
FIG. 51. Limnophylid 13277 (Ill. St. Lab.).  
FIG. 52. *Anabolia bimaculata*.  
FIG. 53. *Helicopsyche borealis*.  
FIG. 54. *Stenophylax* sp.  
FIG. 55. *Psilotreta frontalis* Banks.  
FIG. 56. *Gara pilosa* Fab.  
FIG. 57. *Brachycentrus nigrosoma* Banks.  
FIG. 58. *Limnephilus indivisus*.  
FIG. 59. *Lepidostoma* sp.

## PLATE IX.

FIG. 60. Hydroptilid II (Cold Spring Harbor). Ventral aspect of the head.

FIG. 61. *Rhyacophila fuscula* Walk.

FIG. 62. Polycentropid 13942 (Ill. St. Lab.).

FIG. 63. *Chimarra* sp. (Ithaca).

FIG. 64. *Mystrophora americana* Banks.

FIG. 65. Hydropsychid 27006 (Ill. St. Lab.).

FIG. 66. Hydropsychid 27256 (Ill. St. Lab.).

FIG. 67. *Hydropsyche incommoda*.

FIG. 68. *Macronema zebratum* Hag.

FIG. 69. Leptocerid I (Cold Spring Harbor). Ventral aspect of the labium and maxilla.

FIG. 70. *Leptocella uwarowii* Kol.

FIG. 71. *Molanna cinerea* Hag.

FIG. 72. *Ganeonema americanum* Walk.

FIG. 73. *Psilotreta frontalis* Banks.

FIG. 74. *Brachycentrus nigrosoma* Banks.

FIG. 75. *Arctecia medialis* Banks.

FIG. 76. Hydroptilid I (Cold Spring Harbor).

FIG. 77. *Rhyacophilid* I. Tolon, Colo.

FIG. 78. Philopotamid 26993 (Ill. St. Lab.).

FIG. 79. *Mystrophora americana* Banks.

FIG. 80. *Phylocentropus* sp.

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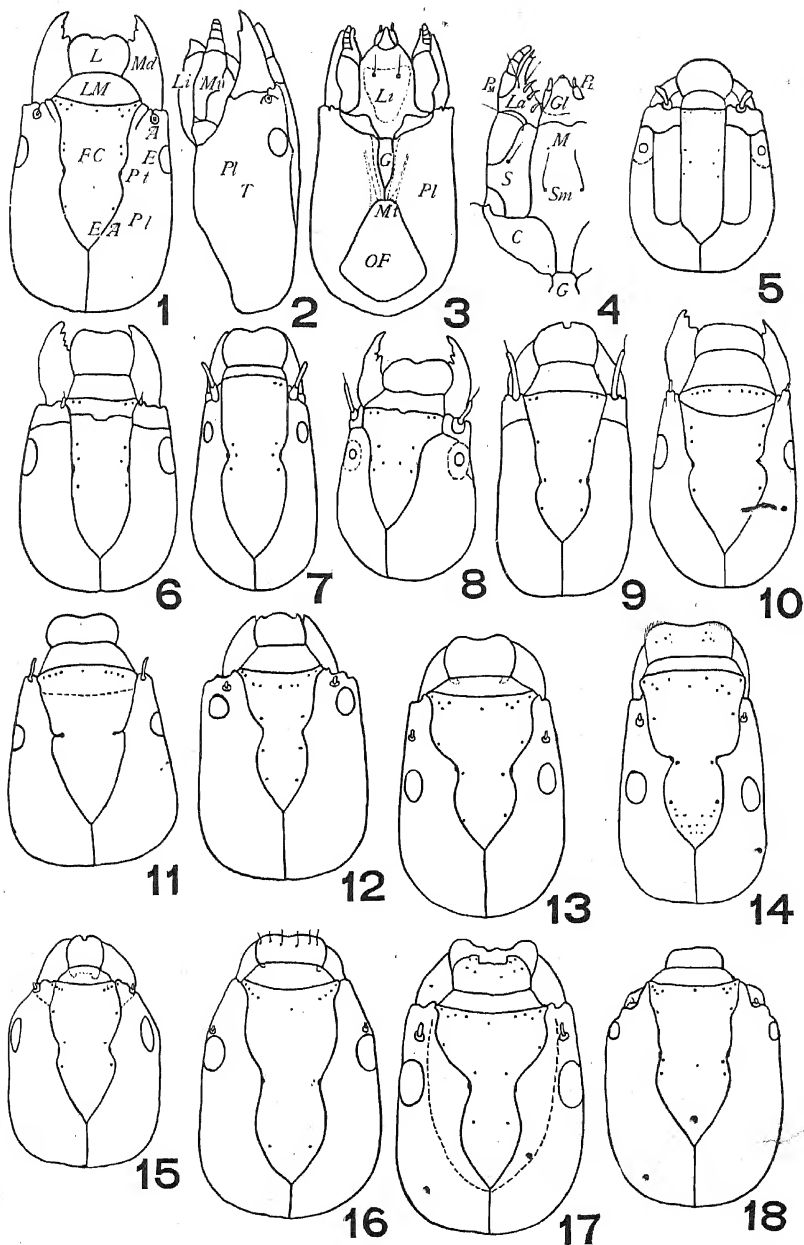
## A NEW WALKING-STICK INSECT FROM EASTERN NORTH AMERICA.

By WM. T. DAVIS,

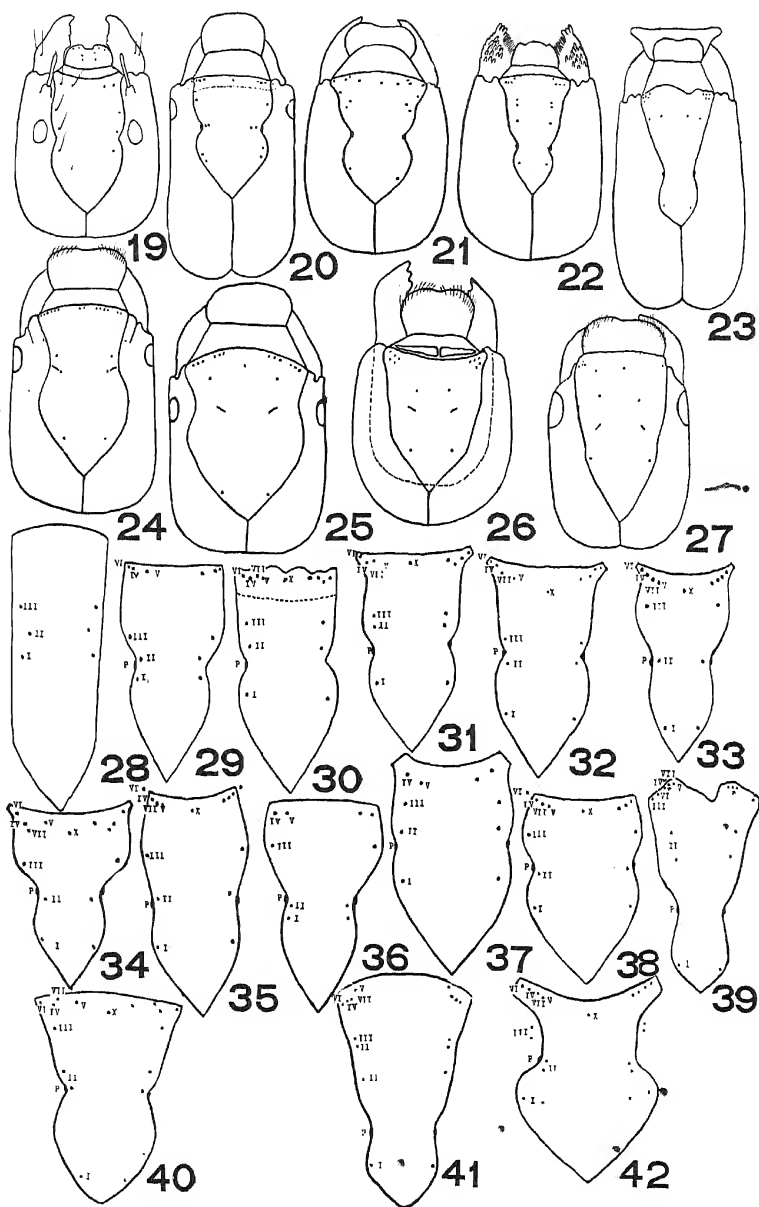
STATEN ISLAND, N. Y.

In the low-lying meadows, and occasionally elsewhere on Staten Island, Long Island, as well as in other localities along the Atlantic coast, there is a walking-stick insect to be found on the golden-rods and associated plants that has interested entomologists for some time. It has passed under the name of *Manomera blatchleyi* (Caudell), but as no males have been recorded, much uncertainty has existed regarding the specific name.

*Bacunculus blatchleyi* Caudell was described in the JOURNAL, New York Entomological Society, Vol. 13, p. 212, 1905, from a male collected in Starke County, Indiana, and according to Mr. Blatchley in

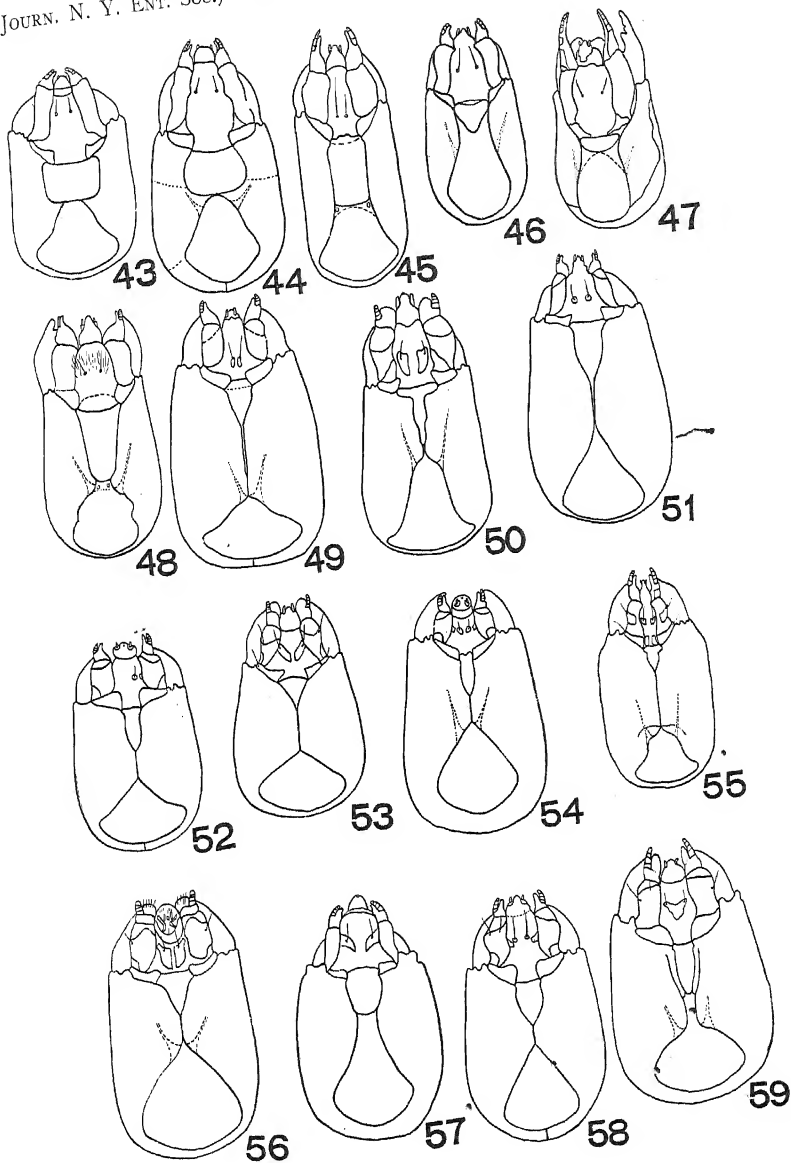






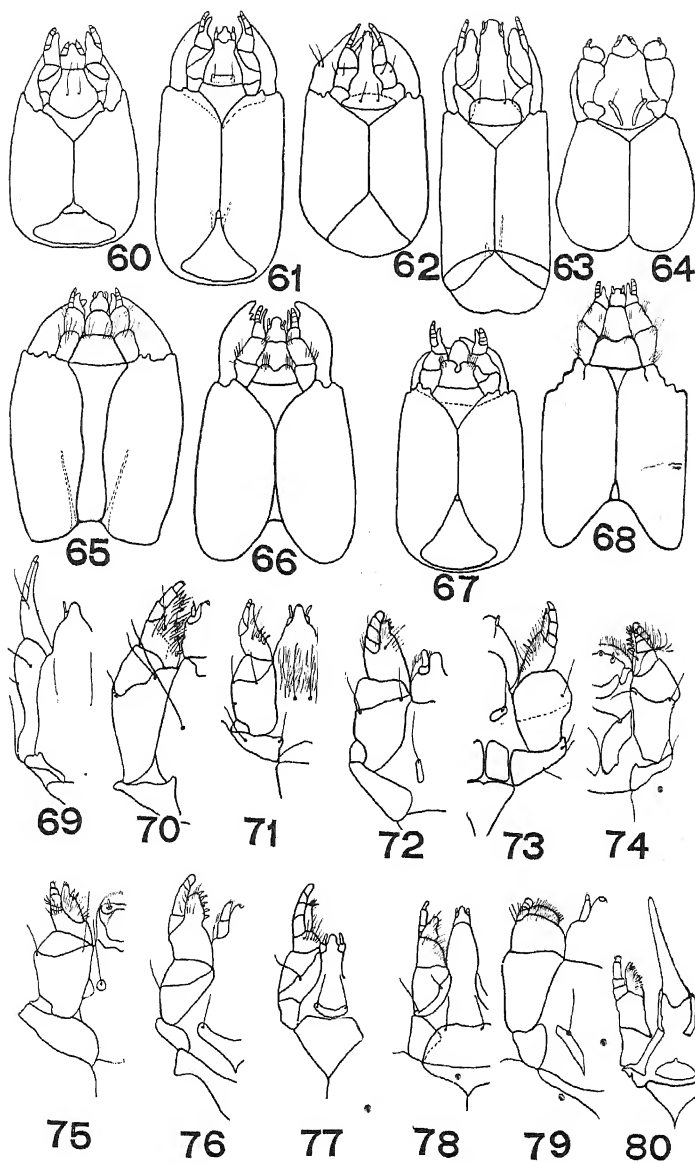
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his Orthoptera of North-Eastern America, has also been found in Missouri, Iowa, Wisconsin, Ohio, and Illinois. Through the kindness of Mr. William J. Gerhard, I long ago received a male and female of this species collected in September at Palos Park, Ill., and in 1922 he sent me an additional female from Palos Park; five females from Argo, Ill., as well as several males from both of these localities.

Comparing the seven females with the forty-six females collected on Staten Island and Long Island, as well as those from other localities along the Atlantic coast, it was noted that they differed in the shape of the head, length of legs and cerci; also in the shape of the sub-genital plate. In the original description is the statement: "Cerci of female rounded and as long as the terminal segment of the abdomen."

On the plate accompanying this article the first four figures represent eastern specimens, while the last four are from photographs of a like number of females sent to me by Mr. Gerhard, which appear to represent the true *blatchleyi*, Fig. 8 having measurements about as given in the original description. The differences shown by these figures are, we think, sufficient to constitute at least a geographic race, and very likely if the male of the eastern form is found, the differences will be still more apparent.

*Manomera blatchleyi atlantica*, new race. Plate X, Figs. 1 to 4.

Resembles *blatchleyi* as described by Caudell and by Blatchley (*loc. cit.*), except that the head in *atlantica* is broader across the eyes and tapers gradually toward the posterior margin, whereas in typical *blatchleyi* the sides of the head are much more nearly parallel. Specimens of the same length, when compared, have the legs in the eastern examples longer and the cerci shorter, than in those from Illinois. The cerci are much shorter than the last abdominal segment in *atlantica*, whereas in *blatchleyi* they are more nearly of the same length. These differences are shown on the accompanying plate. The subgenital plate in *atlantica* has the extremity, as a rule, more evenly rounded than in *blatchleyi*, where it is often quite pointed.

Length of head in female type 3.5; pronotum 3.25; mesonotum 15; metanotum 12; fore femora 18; middle femora 14; hind femora 19; cerci 3 mm.

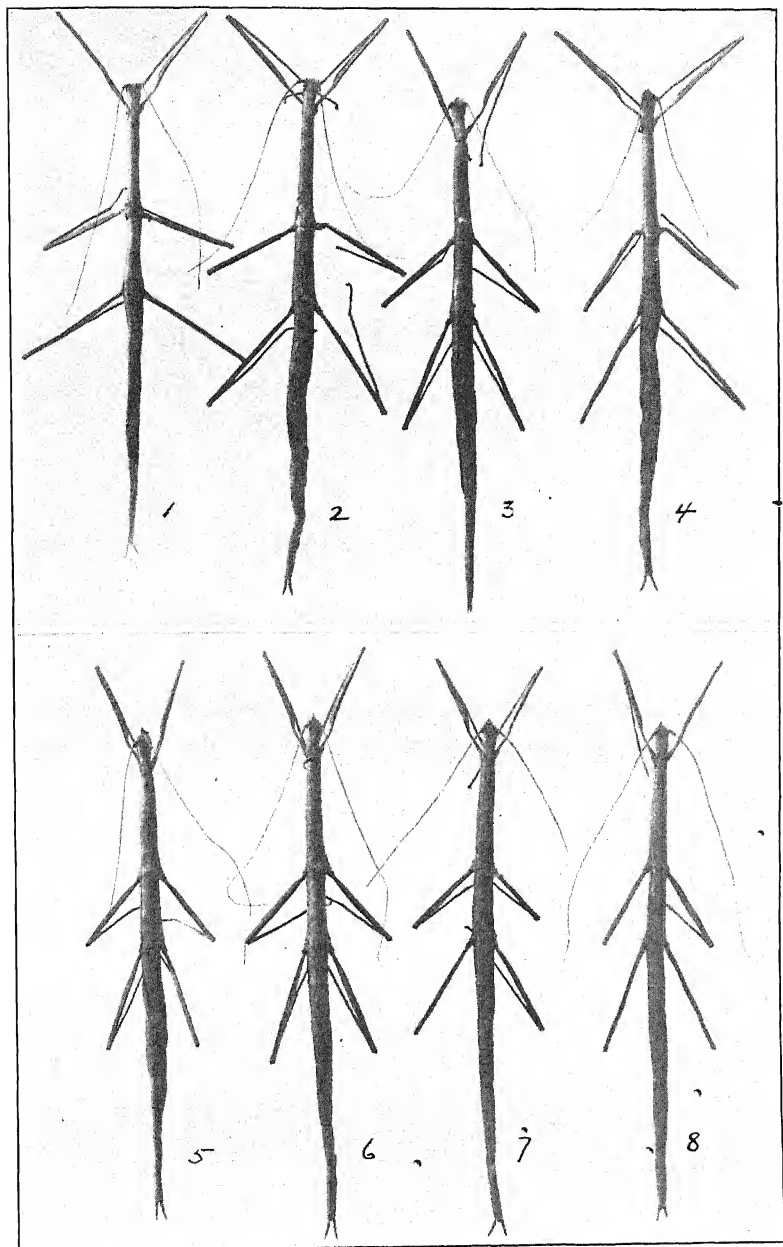
Type female, Clove Valley, Staten Island, N. Y., September 9, 1893. Davis collection.

In addition to the type, three other mature females have been collected on Staten Island, at Richmond Valley, Sept. 23, 1883; Mariners' Harbor, Sept. 26, 1903, and one on August 7 without definite locality. Numerous female nymphs have been found in the Clove Valley, at

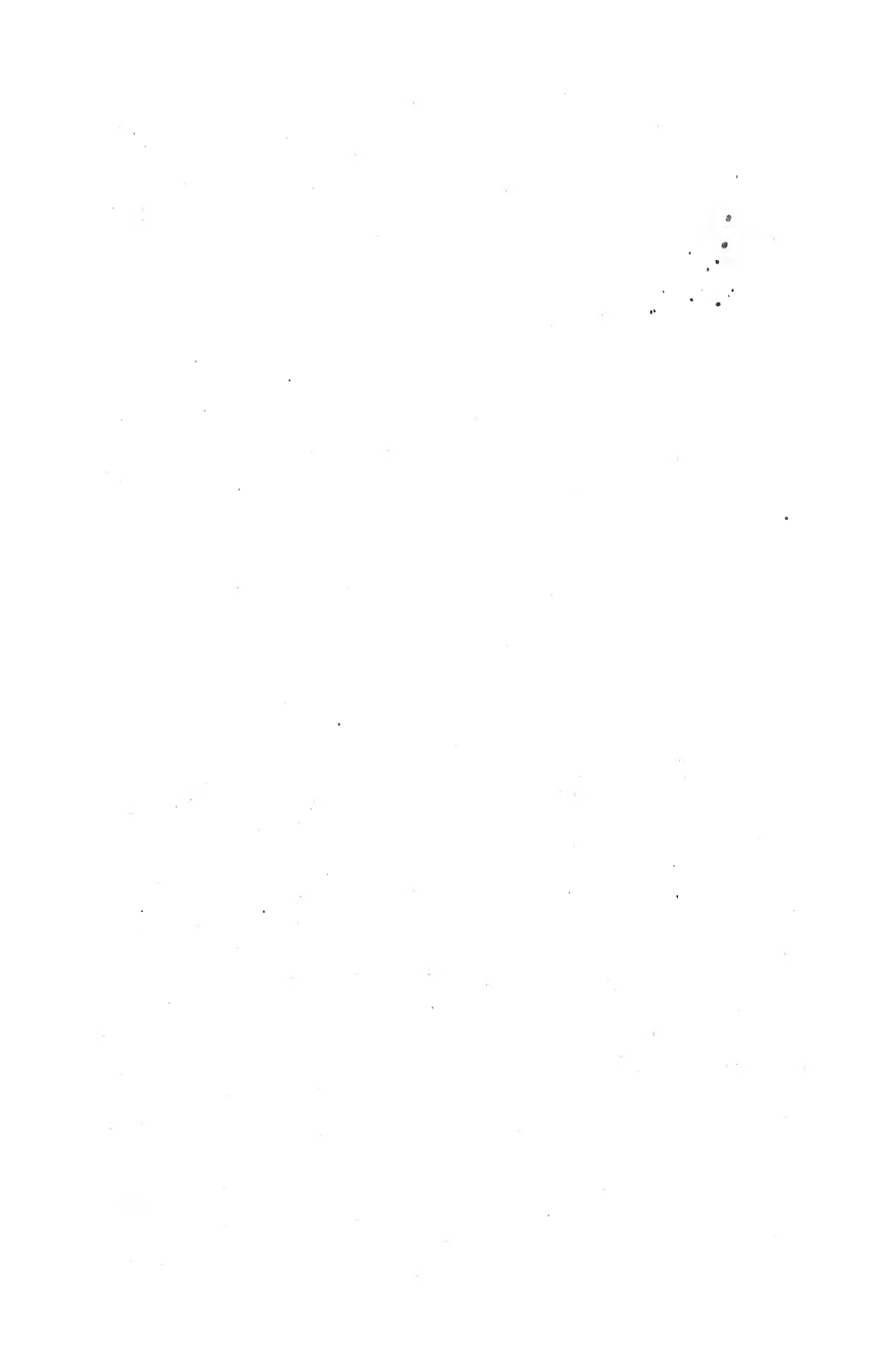
Watchogue, and near Richmond, in the months of June, July and August. On Long Island no less than forty-two females have been collected; many more were found but allowed to escape. The greatest number (31) have come from a piece of low-lying ground at Maspeth, where Mr. C. E. Olsen located a flourishing colony in 1912. Here, near the habitations of man, and apparently free from many natural enemies, they were quite numerous. Very often in an hour or two, we could find a dozen or more, usually on *Solidago rugosa*, as well as on other species of golden-rod and associated plants. When additional specimens were needed in 1922, Mr. Frederick M. Schott collected twenty-one females on the afternoon of September 23, and let a few others go. Mr. Olsen, Mr. Schott and I have looked particularly for the male in this locality at several seasons of the year, both by day and night, but thus far without success. Many of the specimens found are green, but they may be grayish, brownish, or even purplish in color. Elsewhere on Long Island females have been collected at Brooklyn, Flushing (E. L. Bell, Dr. W. H. Wiegmann and W. T. Davis), Roslyn, Setauket (G. P. Engelhardt), Sea Cliff, Wading River, River Head, Amityville (Edw. D. Harris), and Blue Point. The dates of capture for mature specimens range from July 30, 1919 (Wading River), to Oct. 1, 1918 (Setauket).

From elsewhere the writer has specimens as follows: New Haven, Conn., Sept. 4, 1911 (C. E. Olsen); Crotona Park, N. Y. City, Oct. 9, 1904 (Frank E. Watson); Paterson, N. J., Aug.; Plainfield, N. J., Oct. 20, 1916 (W. De W. Miller); Keyport, N. J. (no date); Erma, Cape May Co., N. J., August, 1912, 10 females; Dyke, Va., July 18, 1913 (Davis), and Vienna, Va., Aug., 1918 (H. G. Barber).

The only other species of walking-stick insect found in the north-eastern states is *Diapheromera femorata* (Say). It has not been collected on Staten Island, but on Shelter Island (Long Island) it was quite common a number of years ago according to Mr. Adolph W. Callisen. In the fall of 1922 Mr. Roy Latham found a number at Orient, Long Island. Elsewhere on the neighboring mainland, it is often quite common, feeding on a number of trees and bushes, but it is not as a rule found on herbaceous plants, as is *Manomera atlantica*.



MANOMERA



## EXPLANATION OF PLATE.

FIG. 1. *Manomera blatchleyi atlantica*. Type. Clove Valley, Staten Island.

FIG. 2. *Manomera blatchleyi atlantica*. Richmond Valley, Staten Island.

FIG. 3. *Manomera blatchleyi atlantica*. Maspeth, Long Island.

FIG. 4. *Manomera blatchleyi atlantica*. Vienna, Virginia.

FIGS. 5-8. *Manomera blatchleyi*. Argo, Illinois.

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## PROCEEDINGS OF THE NEW YORK ENTOMOLOGICAL SOCIETY.

### MEETING OF MAY 17.<sup>1</sup>

A regular meeting of the New York Entomological Society was held at 8 P.M., on May 17, 1921, in the American Museum of Natural History, Vice-president Harry B. Weiss in the chair with 21 members and 1 visitor present.

Mr. Woodruff made an exhibition of "Insects collected in Alabama," saying that most of the material was collected after April 1, when the season seemed to open suddenly. The membracids were discussed at length, especially in regard to their sexual characters. The locality visited was Hazen, about 70 miles southwest of Montgomery.

Mr. Bell read a paper, "Notes on Florida Collecting," descriptive of 26 warm, rainless days and cool nights spent near Tampa and Gulfport, during which 64 species of butterflies were found.

Dr. Bequaert reviewed the chapters on Mimetic Butterflies in Carpenter's "A Naturalist on Lake Victoria" giving incidentally a general discussion of mimicry, the conflicting views of various authors and his own experiences in Africa.

### MEETING OF OCT. 3.

A regular meeting of the New York Entomological Society was held at 8 P.M., on October 3, 1922, in the American Museum of Natural History. President John D. Sherman, Jr., in the chair with 18 members and two visitors present.

A minute recording the death of Silas C. Wheat and the regret of his fellow members was ordered.

Mr. Wm. T. Davis exhibited a specimen of *Xylotrechus aceris* Fisher, taken at St. George, Staten Island, in July, 1921. This species was described in the Proceedings of the Entomological Society of Washington, 1916, from specimens collected in Washington, District of Columbia; also from Delaware, Kentucky, and Pennsylvania. It is said to be "closely allied to *quadrimaculatus* Hald., from which it differs by having the four spots on the thorax of sparse white pubescence instead of dense yellow pubescence, by having the

<sup>1</sup> Meeting of May 17, 1921, omitted by accident.



antennae shorter, and also by its habit of making galls on maple trees, while *quadrinaculatus* girdles the branches of various trees similarly to *Elaphidion villosum* Fabr."

Mr. Angell recorded finding the green form of *Cicindela tranquebarica* at Yonkers, May 21, *Necrophilus pectiti* at Cooks Falls, Delaware Co., N. Y., on September 25, *Dytiscus harrisi* at East Branch, N. Y., on July 29, and about 30 specimens of *Myas cyanescens* at Montauk, Long Island, on August 27.

Mr. Olsen recorded a pink form of the Fulgorid *Amphiscepa bivittata* at Ulster Park.

Mr. Hall spoke of a Lakehurst trip with Mr. Woodruff, of a trip to the Peninsula of Maryland with Mr. Jones, of another to Mt. Desert and of six days in the island of Newfoundland—of the latter more details will be given on October 17.

Mr. Bell showed specimens of *Astyanax* form *albo-fasciata* Newcomb.

Dr. Lutz referred briefly to his experiences in Colorado, showing pictures of Long's Peak and praising the automobile that carried him there and back.

Dr. Bequaert spoke of his visit to his relatives in Europe and of the Museums he had visited in Paris, Brussels and London, where he had been able to examine many types. He showed some of the Guides and sets of cards relating to insects he had obtained at the British Museum and the famous early work of Meigen on Diptera, which he had obtained from L. Bedel's library, and of which only three copies are known. Dr. Bequaert also exhibited the current number of "Hobbies" devoted largely to the collection of the late Dr. E. G. Love, now owned by the Buffalo Society of Natural History. He also exhibited and described in some detail *Triatoma rubromaculata* referring especially to their domesticated habits and function in carrying disease. Their usefulness also in diagnosing certain diseases from the rapidity with which they become infected with Trypanosomes was pointed out.

Mr. Shoemaker spoke of trips to Wading River with Messrs. Davis and Schaeffer, to Montclair with Messrs. Quirsfeld and Nicolay and to the Catskill Mts. where he had found a *Saperda* possibly new, and other rare and interesting moths and beetles.

Mr. Barber had spent most of the summer near Washington, D. C., with good results; a Ceratocomid obtained by sifting, *Leptostyla oblonga* and other species were mentioned. A special study of the genus *Triatoma* had been made and will be spoken of at a later meeting.

Mr. Dickerson had also been active. Monmouth Junction with Weiss; Berkeley Hts. with Bischoff; Lakehurst with Messrs. West, Davis, and Barber were among his exploits. At Hackettstown he had collected leaf hoppers successfully in low pasture grass and at Glenwood Lake had had other successes.

Mr. Lesieski reported finding a red form of *Cicindela generosa* in New Jersey.

Mr. Levine had wandered as far as Mexico.

Mr. Schwarz had to report on Bermuda, where he had found Monarch butterflies, cicadas, honey bees, and other introduced insects in plenty, but wild bees and Spingids scarce.

Mr. Davis said the Bermuda *Tibicen bermudiana* greatly resembled our lyricin; and that the great number of Monarch butterflies was only a return to normal conditions, the scarcity for a few years following the cold winter of 1917-1918 being a temporary condition. He also described Mr. Shoemaker's devotion to science as exemplified by his bleeding legs after he had waded into Long Pond to catch Donacias and got leeches as well.

Mr. Sherman closed the evening with an interesting account of his northern wanderings, which included a visit to Mr. Notman at Keene Valley, and the ascent of Mt. Marcy: two weeks in Canada with Chagnon, Swaine, McDonough and others; White Mts., Lake Champlain, and Vermont. Among the entomological results were the acquisition of a set of *Le Naturaliste Canadien*, a view of the Provencher collection and the resolution to print a paper on *Agabus*, inspired by Fall's publication of *Hydroporus*. Mr. Sherman closed his share of the evening by exhibiting a petition dated August 22, 1873, found in the Uhler correspondence signed by Dr. Leconte and many other famous entomologists of that date.

#### MEETING OF OCTOBER 17.

A regular meeting of the New York Entomological Society was held at 8 P.M., in the American Museum of Natural History. President John D. Sherman, Jr., in the chair with 16 members and 6 visitors, including Messrs. Edgar Nelson, Arnold Seigel and Louis Eisman, present.

The president, with great sorrow, announced the death of L. R. Reynolds, aged 44. Mr. Reynolds, famous for his work on *Onus* in California, had lived for some years in Mexico, and traveled lately in Venezuela and Trinidad. Though apparently robust, he had really been in poor health for some years; illness necessitated his return to his home near Boston, where he died on October 9. The secretary was instructed to express the regret and condolence of the Society by letter to Mrs. Reynolds.

Mr. Hall exhibited "Some Newfoundland Butterflies," and in describing them spoke of his arrival at Port aux Basques on July 26, when snow still lingered on the mountains, and of the opportunity he had on account of a train accident of collecting lowland forms soon after. *Eurymus interior*, *Argynnis atlantis*, *Phyciodes tharos*, *Heodes epixanthe*, and *Polites peckius* were shown. At Port au Port he found the tree line at 600 feet elevation and obtained *Eurymus pelidne* and *Plebius aquilo*. General collecting about Port au Port yielded a sight of two species of *Papilio* and specimens of *Brenthis myrina*. The strong wind in elevated localities made the use of a very light net with stick of balsam wood desirable. His remarks were discussed by Messrs. Engelhardt and Leng. Mr. Engelhardt described the fierce wind blowing in from the bay at Port au Port, causing the sprawling spruces upon whose branches one could walk; also the beauty of the orchids of the lowland bogs. As to

*Papilio brevicauda*; he said adults were scarce in late July and August but larvæ were to be found feeding on wild parsnip. He had taken a number home, from which about two dozen adults were later bred. He also spoke of the night collecting at George's Pond as remarkably good.

Dr. Bequaert spoke at length under the title "Further Considerations upon the Color Variations of Wasps, as illustrated by the genus *Synagris*" using three boxes of specimens as illustrations, together with a map of Africa, on which the range of the species was indicated and a color plate which he had already published. In his remarks were also embodied the results of studies at the British Museum, which covered practically all the known species of the genus *Synagris*. He said that he did not mean his remarks to be understood as applying beyond the wasps referred to but in those it was very plain that considerable variation in color not correlated with variation in structure was observable, and that a uniform type of color was often found in widely differing species. 12 color forms of *Eumenes maxillosus* and many forms of *Synagris cornuta* were used to illustrate the first rule and 15 species all black with orange tip to the abdomen were used to illustrate the second rule. After discussing the relative value of color and structure in taxonomy, the bearing of distribution upon the problem, the treatment it had received from ornithologists and other students, Dr. Bequaert came to a discussion of the way in which such color variations had arisen. The various theories that have been advanced were each considered, leading finally to the conclusion that we do not as yet know as much about color as we do about structure, especially respecting the factors producing it. His remarks were followed with close attention and were discussed by Messrs. Notman, Engelhardt, and Leng.

Mr. Notman exhibited an unusual Monarch butterfly, in which the right-hand wings were much smaller than the left-hand wings. Notwithstanding this crippled condition, the butterfly had flown into Mr. Notman's window.

Mr. Wm. T. Davis exhibited a female *Megaphasma dentricus* (Stol) measuring 160 mm. in length, and stated that it was the largest species of walking-stick insect so far found within the limits of the United States. The specimen was collected at Neshoba, Mississippi, July 6, 1922, by J. G. Hallford, and received through the courtesy of Professor R. W. Harned.

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### THE GROUP TRACHES IN NORTH AMERICA. PART II<sup>1</sup>. THE GENUS BRACHYS (COLEOPTERA).

BY ALAN S. NICOLAY AND HARRY B. WEISS,

NEW BRUNSWICK, N. J.

*Brachys* Solier, 33-312.

Broadly ovate, triangular in form; scutellum small, triangular, surface glabrous, very variable, flat to concave, or with a transverse carina, such variations occurring in large series of the same species; thorax widest and transversely depressed at the base; front convex, hind angles with a distinct carina, eyes convex; head longitudinally impressed with a more or less distinct glabrous tubercle above each eye; antennæ very short and inconspicuous, received in distinct grooves on the under side of the thorax near the margins, II-jointed, first two joints largely inflated, next three small suboval, last six serrate; elytra rather irregularly punctured and with a distinct lateral carina reaching almost to the apex which is pectinate, two other carinæ on elytra shorter and less distinct (carinæ interrupted or entirely wanting in certain Central American species); elytra concave along margins behind shoulders, sides sinuate to about apical half thence narrowed toward apex; entire dorsal surface with more or less pubescence arranged in rather distinct sinuate fasciæ on elytra; legs retractile, tibiæ linear, last tarsal joint as long as first four combined; prosternum obtuse behind; ventral surface smooth to very finely punctulate, ventral segments rather convex with short sparse pubes-

<sup>1</sup> Continued from JOUR. N. Y. ENT. SOC., Vol. XXVIII, No. 2, 1920, pp. 136-150. Part I, The Genera *Pachyschelus* and *Taphrocerus*.

cence arranged in somewhat transverse lines, last ventral segment of females in some species with a deep emargination and with long fimbriate hairs along emargination. Our species are black, usually with a metallic lustre.

Despite the great variations in size and color of some of our commonest species we do not feel that the erection of any new species is warranted. In a limited collection containing but few examples, the extremes could be easily separated into valid species but upon assembling a larger series innumerable intergrading individuals would make the task difficult and cause no end of trouble for future students. Even with the present eight well-defined species and three varieties, the construction of a workable key was rather difficult and as all of our forms possess the distinct lateral carina<sup>1</sup> of the elytra, we are forced to base one division solely on the sexual characters of the females which fortunately for this purpose at least, appear to far outnumber the males.

The genus is rich in specimens if not species and its members occur in all of our Eastern States from Canada through Florida and out west from Edmonton, Alberta to Texas, Arizona, thence through Central America to Brazil and Peru. Strange to say the Pacific Coast States appear to be without a single representative.

Comparatively little is known of the life histories of the members of the genus although it is quite probable that most of them are leaf-miners in their larval stages and leaf-feeders as adults. In the literature the habits of *Brachys ovatus* and *Brachys ærosus* have been referred to briefly by Packard, Riley, Gillette, Felt, Blatchley, Burke, Knull and others. In New Jersey we have observed *Brachys ovatus* feeding on the foliage of elm, sugar maple, white oak, chestnut oak, pin oak, scrub oak, black oak, post oak, chestnut, beech and hickory with the oaks as preferred food plants and *Brachys ærosus* feeding on beech, linden witch hazel, elm, chestnut, sugar maple, red maple and various species of oaks with the oaks as preferred food plants. The feeding of both species is similar and quite characteristic, the tissue between the larger veins of the leaves being consumed. This results in the injured portion having a somewhat ragged, geometrical appearance.

<sup>1</sup>The key in Biol. Cent. Amer., Vol. III, Part I, p. 131, separates the species by the lateral carina being continuous, interrupted or entirely wanting.

The eggs resemble drops of transparent, watery excrement, being very flat, oval and rounded at both ends. They are deposited as a rule on the upper leaf surface many of them close to the margins. The young larvæ enter the leaf tissue directly beneath the eggs and mine the tissue in irregular areas around the eggs or in gradually widening, elongate areas away from the eggs and somewhat parallel to and against the leaf edges. Many mines are blotch-like and while they may occur on any portion of a leaf, most of them are located near the edges. As a rule each mine contains only one larva and is found on a leaf which is comparatively uninjured by adult feeding. The mines are visible on both leaf surfaces more so on the upper where they appear as brown, dead spots or areas. On large trees only the outer leaves which are exposed to plenty of sunlight appear to be mined or fed upon. Most of the mines occur on oak foliage in spite of the fact that the leaves of many other trees are used as food by the beetles. After becoming full grown, the larvæ leave the mines and pupate on or slightly under the surface of the ground.

The larvæ of both *ovatus* and *ærosus* are slightly wedge-shaped and much flattened. The body is composed of thirteen well-defined segments and is deeply notched or lobed. The head and mouth parts are dark and the head is more or less retracted into the first segment. The first segment is as broad or slightly broader than the following ones, the body gradually tapering posteriorly. The first segment bears a large well-developed, somewhat smooth, shining, subquadrate plate on both dorsal and ventral surfaces, the dorsal plate having a median line groove. The first seven abdominal segments are produced laterally into pronounced, rounded lobes and the lobes of the fifth to ninth segments each bear a group of several stout, minute spines. The posterior edge of the eighth abdominal segment is fringed with a row of minute, stout spines. The color of the larva is whitish with head and mouth parts dark and a broad, median, dorsal, abdominal line is indicated on segments one to eight. Both eggs and larvæ are parasitized by the larvæ of *Closterocerus cinctipennis* Ash.

#### KEY TO THE SPECIES OF BRACHYS.

1. Tubercle above the eye very prominent, convex, and extended when viewed laterally; apical half of elytra sometimes with a tuft of black and ferrugineous hairs.....2.
- Tubercle above the eye not at all prominent or extended; apical half of elytra never with a tuft of hairs.....3.

2. Elytra each with a distinct tuft of black and ferrugineous hairs; tubercle moderately prominent and extended; length, 5-5.5 mm.

*floccosus* Mannerheim.

Elytra without a tuft of hairs; tubercle greatly extended and prominent; length, 4-4.5 mm.....*cephalicus* Schaeffer.

3. Last ventral segment of female deeply emarginate with long, fimbriate hairs along emargination; elytra usually with three or more narrow, sinuate white fasciæ.....4.

Last ventral segment truncate or rounded in both sexes; elytra without three sinuate, narrow, white fasciæ.....8.

4. Steel blue; pubescence whitish, arranged in narrow, sinuate fascia.

*tessellatus* Fabricius.

Pubescence denser, golden silvery or ferrugineous bordered by narrow white fasciæ.....5.

5. Vestiture very dense, form broad, punctuation of elytra coarse and regular .....6.

Vestiture not so dense; form usually more narrow; punctuation of elytra shallow and uneven, apical half of elytra with broad, glabrous, transverse space.....7.

6. Pubescence ferrugineous bordered by narrow white fasciæ.

*floricola* Kerremans.

Pubescence entirely light golden to silvery.

*floricola* var. *blatchleyi* new variety.

7. Pubescence ferrugineous bordered by narrow white fasciæ or maculæ.

*ovatus* Weber.

Pubescence entirely light golden to silvery.

*ovatus* var. *bellporti* new variety.

8. Black; elytra with a single, broad, white fascia just behind the centre; last ventral segment broadly rounded.....*fasciferus* Schwarz.

Metallic; elytra without single, broad white fascia; last ventral segment not noticeably broadly rounded.....9.

9. Pubescence gray to fulvous or yellowish, generally bicolored; elytra usually blue sometimes blackish or with æneous or purplish lustre; length, 3-5.75 mm.....*ærosus* Melsheimer.

Pubescence brilliant cupreous to ferrugineous; elytra usually cupreous or brassy.....*ærosus* var. *rufescens* new variety.

Pubescence dense, uniformly light golden to silvery; elytra black often with æneous lustre; length, 3-3.75 mm.....*æruginosus* Gory.

*Brachys floccosus* Mannerheim, 37-118 (Plate XI, fig. 1).

(Translation of original description.)

"Short ovate, obscure glittering-violaceous bronze, head excavated 4-nodulose, base of thorax strongly dilated, variegated with griseous and fulvous, sides of elytra costate striate-punctate, base densely

whitish pubescent from there variegated with black and griseous pubescence, separatel a little behind middle into two bands, pubescence at base orange, at apex black. Mexico: Oaxaca Longit. 5 mm. Latit. 3 mm.

"Head deflexed, front excavated variegated with griseous and orange pubescence, with a pair of small shining nodules, vertex globose, binodulate, largest tubercle less elevated. Antennæ shorter than head and thorax together, cupreous. Thorax short, front twice as narrow as base, sides scarcely rounded, base deeply trisinate, median lobe strongly produced, above roundly elevated, posteriorly transversely depressed, variegated with griseous fulvous and blackish pubescence. Scutellum triangular, obscure violaceous. Elytra at base as broad as thorax and three times longer than the same, humeri straight prominent, sides from there on almost straight, feebly margined, gradually narrowed a little behind the middle on both sides, carinate from humeri to beyond middle, carina curved inwardly, remotely striate-punctate, anterior third entirely thickly whitish-pubescent from there on variegated with black, griseous and fulvous pubescence, separated a little behind the middle into two obliquely placed bands, pubescence orange at base, black at apex and behind that near apex two whitish pubescent bands, outwardly orange. Ventral surface with feet violaceous-cupreous punctulate."

Ovate. Elytra usually steel-blue, rather gradually narrowed toward the apex, pubescence dense, white, forming an indistinct sub-basal fascia bordered with brownish pubescence along the margins which becomes more conspicuous and predominates toward the tips of the elytra; a distinct tuft of black and ferrugineous hairs at about apical two-fifths. Thorax, head and ventral surface æneous; a distinct rather bare tubercle above each eye. Last ventral segment broadly truncate, segments punctulate with short, sparse, silvery pubescence. Length 5-5.5 mm.

*Localities.*—Chirique Mts., January 6 (Hubbard and Schwarz); Huachuca Mts., July 11 (Schaeffer, Wenzel, Biedeman); ARIZONA. Oaxaca, Juquila, Parada (Salle); MEXICO. San Geronimo, Capetillo, Cerro Zunil 4000 feet (Champion): GUATEMALA.

This Central American form is the most beautiful and bizarre of all our species. Its large size, distinct tufts of hairs near the tips of



the elytra and broadly truncate ventral segment at once separate it from all of our other species. On oak (Schaeffer).

*Brachys cephalicus* Schaeffer, 99-377 (Plate XI, fig. 2).

(Original description.)

"Head strongly convex above the eyes and deeply, longitudinally impressed at middle, giving this part the appearance of two large tuberculiform elevations; between the eyes are two similar, but smaller elevations; surface not very densely clothed with golden pubescence; sculpture rather reticulate. Thorax æneous, clothed not densely, with golden pubescence; disk smooth, the basal impressions and at apex with large, somewhat ocellate punctures. Elytra as in *ovatus* Web., but the markings towards apex more ferruginous and golden than in that species. Underside black; surface sculpture very finely reticulate, sparsely intermixed with semicircular impressions, each of which gives rise to a single white hair; apex of abdomen coarsely toothed. Length 4 mm. Huachuca Mts., Arizona.

"Readily known from any of the North American species by the head above the eyes more strongly convex than in *floricola* and *fascifera* and by the relatively longer thorax." ..

*Localities*.—Huachuca Mts. (Schaeffer), "Arizona" (Horn Coll.); ARIZONA.

Very closely related to preceding from which it may be readily separated by the absence of tufts of hair near elytral apices, smaller and narrower size, very prominent tubercle above each eye (which easily distinguishes it from all of the following species) (see figure 2), and the golden pubescence of the thorax, base and tips of the elytra; the rarest of our North American *Brachys* and represented in but few collections. Up to the present Arizona is the only state in which *cephalicus* has been found. In the Horn collection at the Academy in Philadelphia there is a small series bearing the manuscript name *frontosa* Blanchard, all marked males and with only the state label.

*Brachys tessellatus* (Fabricius), 91-218 (Plate XI, fig. 6).

*lugubris* Le Conte, 59-251.

(Translation of original description.)

"*Trachys*. palpi four very short, equal. Maxilla bifid. Antennæ moniliform.

"*Tessellate*. I. T. black elytra whitish tessellate. Habitat in Carolina. Mus. D. Bosc. Mouth with maxillæ and palpi. Palpi four very short, equal, filiform, anterior ones scarcely longer four jointed; joints subequal adherent to upper surface of maxillæ, posterior ones three-jointed; joints equal, growing from the external-centre of the ligula. Mandibles short, corneous without teeth, acute. four, very short, equal, filiform, anterior ones, scarcely longer, Maxillæ membraneous, bifid; fringe equal, obtuse. Ligula short, membraneous, entire. Labium short, corneous, transverse, entire.

"Larger than *T. pygmæa*. Color of head and thorax variable varying from black to obscure aurulate. Elytra substriate often colorous, whitish-tessellate. Body black, shining."

Broadly ovate, slightly sinuate from shoulder to about apical half thence rather gradually narrowing toward apices of elytra. Shining black to steel-blue in color. Elytra unevenly punctate striate, lateral carina prominent reaching almost to apex, median one less distinct and almost joining lateral carina toward apex, sutural carina rather vague, shorter and interrupted near middle; pubescence whitish to dirty gray, arranged in three irregular, sinuate, transverse fasciæ, which when closely examined are seen to be formed by distinct, individual spots of pubescence; slightly concave behind shoulders which are prominent, tips pectinate, rather truncate. Scutellum large, transverse, not noticeably punctate. Thorax deeply, transversely depressed and widened at base, smooth to very minutely granulate, pubescence along margins becoming sparser toward centre. Head with deep longitudinal impression, rather concave, pubescent. Eyes prominent. Ventral surface steel-blue to æneous or blackish, ventral segments granulate with very short, sparse, whitish, transverse pubescence, last ventral segment of the female deeply emarginate with long golden to silvery hairs along the emargination, male segment rather broadly rounded without hairs, last dorsal segment pectinate in both sexes. Length 4.5-6 mm.

*Localities*.—Tampa, April 10, Jacksonville, Crescent City (Hubbard and Schwarz); Key West, Lake Mary (Frost and Nicolay collections); FLORIDA. TEXAS. Wilmington, August 1 (Leng); Southern Pines, April 4 (Wenzel, Manee); NORTH CAROLINA. Spring Hill, April 14 (Loding); ALABAMA. INDIANA. (Frost and Leng collections). Beaufort, April 29 (Mason); SOUTH CAROLINA.

A rather uniform species easily identified by its dark color and whitish pubescence. It appears to be confined to the Southern States, the most northern locality known to the authors being Indiana. Certain individuals from here appear to approach *ovatus*, possessing faint dashes of ferrugineous pubescence among the white. This is also the first of several species which have the distinct sexual character of the females being remarkable for the deep emargination of the last ventral segment. After examining a rather lengthy series we find that in the material before us, the males are much the rarer, averaging only one to every thirty females. A recently published record<sup>1</sup> from S. W. Pennsylvania (Dr. Hamilton) we feel is a misidentification and refers to *ovatus* especially as the author Mr. Joseph Knull is inclined to share our view. Mr. C. A. Frost who has examined the type of *lugubris* in the Le Conte collection pronounces it identical with *tessellatus* which species was erroneously placed as a synonym of *ovatus* by Le Conte.

*Brachys floricola* Kerremans, 00-347 (Plate XI, fig. 4).

*cuprascens* Blatchley, 13-23.

(Translation of original description.)

"Subheptagonal, wide, short, slightly convex, clear bronze above with the head and depressed parts of pronotum ornamented by a villosity of golden red; the elytra colored by sinuate bands, formed by the golden red hairs and limited anteriorly by a white border on the end, the anterior band less distinct and less regular than the two others, the second being median and the third præapical. Ventral surface black, brilliant and slightly purple. Length 5.3 mm; Width 2.7 mm. Florida.

"Close to *B. purpuratus* Kerrem., of Brazil, but differently colored and of a different elytral design.

"Head irregularly punctate, surmounted posteriorly by two rounded tubercles, glabrous and smooth, separated by a longitudinal furrow. Pronotum convex on the disk and flattened on the sides, posteriorly having a lateral carina situated a certain distance from the border and subparallel to the border, ornamented by a red villosity more dense on the sides than on the disk; the anterior margin being straight; the sides oblique and subsinuate; the base very sinuate with the median

<sup>1</sup> Knull, Can. Ent., 1922, Vol. LIV, No. 4, p. 86.

lobe wide, projecting and angularly curved at its summit. Shield transverse, triangular with the base convex and the sides straight. Elytra covered with a longitudinal series of large points having on both sides, a rib or carina starting at the base and surmounting the humeral callus continuing along the lateral margin a certain distance from it as far as the summit; the latter subtruncate and rounded exteriorly. Ventral surface punctate, prosternum finely granulate."

Broadly ovate. Elytral punctures coarse, large and in moderately regular rows, vestiture dense, elytra with usual lateral carinae, tips pectinate, truncate to somewhat rounded. Ventral surface blackish with a bronze or purplish lustre, ventral segments very finely granulate with short recumbent, silvery or yellowish, rather sparse hairs; last ventral segment of the female deeply emarginate with long, golden hairs along the emargination; male segment broadly rounded without hairs. Length 4-5.5 mm.

*Localities.*—Billy's Island, Okefenokee Swamp, June (Leng); GEORGIA. Havlover, March (Hubbard and Schwarz); Jacksonville, Tampa, April 19 (Leng coll.); Enterprise, St. Augustine, April 17, (Frost coll.); Sanford, Ormond, March 29-April 6, Dunedin, March 11-April 7 (Blatchley); Miami, March 31-April 3, La Belle, April 18 (Knull, DeLong); Kissimmee, April 20 (Beutenmuller); Orlando, March, Key West (Nicolay coll.); FLORIDA.

Easily separated from the preceding by the dense reddish pubescence. Although in his description Kerremans mentions the head possessing two rounded, glabrous tubercles, they are scarcely at all convex and in no way approach the distinct knobs so prominent in the *floccosus-cephalicus* group, also the longitudinal impression of the head is much less pronounced and shallower than in most of our species. In the rather extensive series before us the females far outnumber the males and are usually longer and more ovate. With the exception of a single individual from Georgia all the specimens are from Florida where the species is found in numbers.

*Brachys floricola* var. *blatchleyi* new variety.

Broadly ovate, slightly sinuate from shoulder to about apical half, thence rather gradually narrowed toward apices of elytra. Black, usually with a bluish-purple or more rarely bronzed lustre. Elytral punctures coarse, large, arranged in rather even striae; lateral carina prominent, median ones less distinct, generally completely concealed by dense pubescence which is entirely of a light golden to silvery color, tips pectinate rather truncate to rounded.

Scutellum large, transverse, impunctate, and glabrous. Thorax and head as in *floricola*, pubescence of uniform silvery golden hue, very dense and almost completely covering tubercles above eyes on head. Ventral surface similar to that of *floricola* except possibly with a denser vestiture, last ventral segment of female deeply emarginate, long hairs along emargination, silvery; male segment broadly rounded. Length, 5-5.5 mm.

*Localities*.—Dunedin, March 11 (Blatchley); Lake Lucy, March 22 (Powell); Orlando (Pearsall); FLORIDA.

Holotype (♂) in the Nicolay collection. Allotype (♀) in the Frost collection. One paratype in each of the Leng and Schaeffer collections.

This variety is represented before us by four specimens (one male and three females). It is easily separated from *floricola*, which always has reddish brown pubescence bordered anteriorly by a white margin, by its uniform silvery golden vestiture. As in *floricola* the longitudinal impression of the head is remarkably shallow. *Blatchleyi* is evidently much rarer than the type. We take great pleasure in naming this variety after W. S. Blatchley who has done so much in making known the interesting coleopterous fauna of Florida. Undoubtedly Blatchley's reference to *lugubris*<sup>1</sup> Le Conte applies to this variety.

**Brachys ovatus** Weber, 01-76 (Plate XI, fig. 5).

*aurulentus* (Kirby), 37-162.

*tessellatus* † Cast. & Gory, 39-3.

*terminans* † Cast. & Gory, 39-3.

*molestus* Gory, 41-332.

*laevicauda* Le Conte, 59-252.

*horni* Kerremans, 96-324.

(Translation of original description.)

"Blackish bronze head and thorax golden pubescent, elytra punctate bronze with elevated lines and golden-ferruginous undulating bands. From America. Herschel.

"Size in general three times greater than *B. pygmaea*. Wholly very shining blackish bronze. Head and thorax covered with golden ferruginous pubescence. Margin of thorax reflexed. Elytra punctate with three elevated lines three undulating bands and suture shining. Posterior concolorous. Two small varieties also kindly communicated to me. Herschel. Strongly ovate, small, etc., may constitute a new genus."

<sup>1</sup> Canad. Ent., 1919. Vol. 51, No. 2, p. 30.

Ovate, distinctly sinuate from shoulder to about apical half, thence narrowed toward apices of elytra. Black usually with a virescent or brassy lustre. Elytra unevenly, rather shallowly punctate striate, lateral carina distinct, reaching almost to apex, medial and sutural ones less distinct but usually more so than in *floricola*; pubescence ferrugineous (rarely ferrugino-testaceous), arranged in three irregular sinuate, transverse fasciæ which are bordered by more or less distinct bands of whitish pubescence; concave behind shoulders which are prominent, tips pectinate, rather truncate. Scutellum large, transverse smooth. Thorax deeply, transversely depressed and widest at base, front convex, surface smooth to very minutely granulated, covered with a ferrugineous pubescence more sparse toward centre. Head with longitudinal impression distinct and usually much deeper than in *floricola*, rather concave pubescent tubercles above eyes not prominent. Ventral surface metallic, segments punctulate with very short, sparse whitish pubescence; last ventral segment of the female deeply emarginate with long dirty, golden hairs along the emargination; male segment broadly rounded to slightly truncate, without hairs; last dorsal segment pectinate in both sexes. Length 4-6.25 mm.

*Localities.*—This common species has a very wide distribution occurring in the East from Canada to Florida and west to Texas and Mexico where one specimen was taken at Zacualtipan in Hidalgo (Hoge).

Easily separated from the preceding by the usually more elongate and narrower form, less distinct elytral punctuation, sparser pubescence with a much broader glabrous space between medial and subapical bands and long hairs along the emargination of the last ventral segment of the female sparser. *Ovatus* has been redescribed more often than any of our North American *Brachys*. The *lævicauda* of Le Conte is merely the small form which naturally possesses a less distinct pectination of the tips of the abdomen. We believe that the size of the adult depends more or less upon the amount of food consumed by the larva. Sizes of leaves infested, weather conditions during the feeding season, etc., would affect the larval food supply. Mr. H. W. Wenzel takes a very dark and sparsely pubescent form at Da Costa, New Jersey. A partial loss of vestiture may take place naturally.

***Brachys ovatus* var. *bellporti* new variety.**

Size, punctuation, and shape similar to those of *ovatus* differing only in the pubescence being uniformly of a light golden to silvery color. Black, generally with a bright æneous lustre, rarely purplish to bluish. Length, 4.25-6.25 mm.

*Localities*.—VERMONT (Leng. coll.). Framingham, Natick, May 23-July 27 (Frost); MASSACHUSETTS. Bellport, June 5-25 (Nicolay); Pinelawn, June 14 (Leng), Wading River, June 23 (Nicolay), Long Island; NEW YORK. Mount Pocono, July 8 (Nicolay), Hunters Run, July 11 (Knull); PENNSYLVANIA.

Holotype and allotype in Nicolay collection. Paratypes in Leng, Frost, Knull, Knaus, Amer. Mus. Nat. Hist., and Nicolay collections.

Occurs with *ovatus* but much rarer. *Bellporti* as a variety has the same relationship to *ovatus* as *blatchleyi* has to *floricola*. Named after the town where the type specimens were taken and where the senior author spent three pleasant summers of his early beetle collecting days.

***Brachys fasciferus* Schwarz, 78-363 (Plate XI, fig. 3).**

(Original description.)

"Similar to *B. ovata* but shorter, broader in front and more attenuate behind and easily distinguished by the broad white fascia on the elytra and by the formation of the prosternum. Head and thorax as in *B. ovata* the former less strongly excavated. Elytra striate-punctate, punctures finer and obsolete towards the apex, anteriorly with irregular lines and patches of fulvous and whitish pubescence, behind the middle with a broad fascia of dense whitish pubescence with only a few fulvous hairs intermixed, behind this with two other undulated fasciæ composed of fulvous hairs, bordered anteriorly with white, humeral and marginal carina as in *B. ovata*. Fissure of prosternum not reaching the hind margin but leaving a comparatively broad margin intact; apex of metasternum in the middle suddenly and deeply emarginate. Last ventral segment with the usual marginal sulcus not emarginate in the male, broadly rounded in the female, less broadly in the male, anus very finely pectinate. Length 4-5.5 mm. Florida, not rare, lives on *Quercus viricus*. In *B. ovata* and *tesselata* the undivided portion of the prosternum is very narrow and the metasternum is broadly triangular, emarginate in front."

*Localities*.—La Belle April 19 (Knull), Enterprise May 26, Cedar Keys, Jacksonville, Tampa April 4 (Hubbard and Schwarz), Dunel-

Ion September 19, Anona September 17, Fort Myers September 13 (Rehn and Hebard), Kissimmee April 20 (Mason), Jupiter May 2 (Nicolay coll.); FLORIDA. (Leng Collection.) GEORGIA.

This southern species is remarkably constant in size, color and arrangement of the pubescence. It can be separated from all others by the broad band of whitish pubescence just behind the middle, its uniformly dark color and rather broadly rounded last ventral segment. Also the abdominal segments are more densely pubescent than in our other species, the vestiture consisting of moderately long, recumbent ferrugineous hairs mixed with silvery ones which are dense along margins. Not rare where it is found.

*Brachys ærosus* (Melsheimer), 46-148 (Plate XI, fig. 7).

*tessellatus* ‡ (Melsheimer), 46-148.

(Original description.)

"*Trachys tessellata*. Black, elytra tessellated with white. Fabr. Syst. Eleuth. ii, 218, 1. The female is smaller than the male with the elytra dusky-purple, tinged with steel-blue, apex cupreous, varied with pale ferruginous; beneath glossy black, with the apex of the abdomen rounded. It is the *Buprestis ærosa*, Melsh. Catal."

Broadly ovate, sinuate from shoulder to about apical half, thence narrowed toward apices of elytra. Steel-blue often with a slight brassy or purplish lustre. Elytra very irregularly, rather densely and deeply punctate striate, carinæ same as in preceding species, pubescence ranging from gray to fulvous or yellow, arranged in three more or less distinct very irregular, sinuate, transverse bands, basal and medial bands often almost entirely wanting or represented by mere spots of pubescence, subapical band more decided, uniform and constant; concave behind shoulders which are prominent, tips pectinate. Scutellum large, transverse, smooth, surface variable. Thorax very deeply transversely depressed, widest at base, front convex, impunctate, clothed with short rather dense pubescence. Head with deep longitudinal impression, rather concave, pubescent, tubercles above eyes not very convex or prominent. Ventral surface black, shining or brassy, with very short, sparse whitish pubescence; last ventral segment in both sexes truncate to slightly rounded at sides, segment of female sometimes minutely sinuate but never emarginated as in preceding species. Length 3-5.75 mm.



*Localities.*—The most abundant and probably most widely distributed species being reported from Canada to Florida and west as far as Alberta, Canada in the north to Texas and Arizona in the south. Very common around New York City on oak leaves in early summer.

It is remarkable that this very variable species has been described but once and then only in a brief and inadequate way. *Ærosus* can be separated from *ovatus* and all of the preceding forms not only by lacking the deep emargination of the last ventral segment of the female but by the dense subapical pubescence while the basal and medial bands are usually quite broken and indistinct and never bordered by the narrow white fascia so common in *ovatus*. Furthermore the pubescence of the apex is often yellow or fulvous while that on the remainder of the elytra is gray. The larvæ having habits identical with those of the larvæ of *ovatus*, the great difference in size of certain of the adults may be due to the supposition already advanced. We believe that Le Conte in his revision mistook some of the small specimens of *ærosus* for *æruinosus* when he drew up his description of the species. The form with rather dark elytra and fulvous pubescence appears to be most common in New England where Mr. C. A. Frost has taken quite a large series especially around Framingham, Mass., and Paris, Maine.

***Brachys ærosus* var. *rufescens* new variety.**

Same structural characters as those of the type. Differs only in the pubescence being a brilliant cupreous to ferrugineous, rarely intermixed with fulvo-æneous. Elytra generally cupreous to brilliant æneous but sometimes bluish-purple or very rarely without any purplish tinge. Pubescence usually much denser and fasciæ more distinct than in *ærosus*, especially the basal and medial fasciæ. Other characters identical with those of type. Length, 3.75-4.5 mm.

*Localities.*—Beaver Dam, June 14 (Snyder); WISCONSIN. Iowa City, June 3 (Lindsey); IOWA. Husted, May 22, June 30, Plainfield, June 14 (Nicolay); NEW JERSEY. Framingham, May 26 (Frost); MASSACHUSETTS. Buffalo (Leng collection), Bellport, June 7 (Nicolay), Jamaica, Long Island; NEW YORK. Hummelstown, June 20 (Knull); PENNSYLVANIA.

Type in the Nicolay collection. Paratypes in the Leng, Frost, Knull, Amer. Mus. Nat. Hist., and Nicolay collections.

This variety appears to reach its most distinct development in Iowa where the very depressed, cupreous examples with ferruginous pubescence seem far removed from the typical *ærosus*. However several intermediates and peculiar individuals prohibit the

erection of a valid species. In fact among the hundred or more specimens of *erosus* and its variety before us, are many forms which might fit in either the stem species or the variety. *Rufescens* occurs with *erosus* but not in such large numbers.

*Brachys æruginosus* Gory, 41-335 (Plate XI, fig. 8).

(Translation of original description.)

"Æneous, granulose; thorax dilated; elytra irregular; ventral surface and legs obscure æneous. Length 3 mm. Width 1.75 mm.

"Bronze, granulated. Head finely punctured, very deeply in the middle. Thorax wider than the head anteriorly, gibbous at this part widening posteriorly which forms the very dilated posterior angles; its base is very sinuate and a little raised forming a depression between the gibbosity which is nearer the head and the base of the thorax. Shield triangular. Elytra wider at the base than the posterior angles of the thorax, slightly depressed behind the humeral angles, contracted and rounded at their extremities; these are granulated and irregular. Ventral surface of body and feet of an obscure bronze. This species is placed after *tenella*."

Rather broadly ovate, slightly sinuate from shoulder to about apical half thence gradually to sharply tapering to apices of elytra. Black usually with more or less of a brassy lustre. Elytra punctate striate, punctures coarse, shallow and irregular, intermixed with smaller ones; a very distinct carina running from humerus almost to apex of elytra; pubescence arranged in three irregular sinuate, transverse fasciæ, silvery to light golden in color, never rufescent, one sub-basal, another median and the third near and usually covering apex of elytra, glabrous space between last two fasciæ broadest and most distinct; tips of elytra pectinate, truncate to slightly rounded; humerus distinct, elevated; body somewhat concave behind base. Scutellum narrow, very transverse, generally smooth but subject to the usual degree of variation common in this genus. Thorax deeply, transversely depressed at base, impunctate, widest at base rather sharply narrowed toward eyes; more brassy or bronzed than elytra, pubescence dense along basal and lateral margins, sparsely toward centre. Head with a deep longitudinal impression, concave, shining and with pubescence. Eyes prominent. Ventral surface brassy, abdominal segments with short, fine silvery pubescence, last segment narrowly

truncate to slightly rounded at sides, never emarginate. Length 3-3.75 mm.

*Localities*.—KANSAS. Sioux City, June 24 (Lindsey); IOWA. Framingham, May 31-June 6 (Frost); MASSACHUSETTS. Milltown, May 27; NEW JERSEY. Monmouth, June 22 (Frost); MAINE. Bellport, Long Island, June 5-July 22 (Nicolay); Staten Island (Leng), Pinelawn, Long Island, June 14; NEW YORK. Starke, Pulaski and Marshall Counties, June 11-19, rare (Blatchley); INDIANA. TENNESSEE (Nicolay collection).

This species has the structural characters of *ærosus* while the color and arrangement of the pubescence is similar to that of *ovatus* var. *bellporti*. It differs from the former by its uniformly smaller size and silvery pubescence and from the latter by the female not having the last ventral segment emarginate and always smaller and broader body. There is a rare form that has some ferrugineous pubescence mixed with the gray which however predominates. *Æruginosus* is not as common as either of the above species but is found along with them on the leaves of scrub oak in early summer.

#### LIST OF SPECIES.

##### GROUP TRACHES.

##### *Pachyschelus* Solier, 33-313.

##### *Metonius* Say, 36-264.

*purpureus* (Say), 36-164.

*americanus* Gory, 41-346.

*lævigatus* (Say), 36-164.

*ovatus* || (Say), 25-252.

*punctatus* (Gory), 41-347.

*carbonatus* (Le Conte), 59-252.

*politus* Kerremans, 96-322.

*schwarzi* Kerremans, 92-298.

*caruleus* || Schwarz, 78-364.

v. *oculatus* Schaeffer, 09-377.

##### *Brachys* Solier, 33-312.

*floccosus* Mannerheim, 37-118.

*cephalicus* Schaeffer, 09-377.

*tessellatus* (Fabricius), 01-218.

*lugubris* Le Conte, 59-251.

*floricola* Kerremans, 00-347.

*cuprascens* Blatchley, 13-23.

- v. *blatchleyi* nov. var.  
*ovatus* Weber, 61-76.  
     *aurulentus* (Kirby), 37-162.  
     *terminans* ‡ Cast. & Gory, 39-3.  
     *tessellatus* ‡ Cast. & Gory, 39-3.  
     *molestus* Gory, 41-332.  
     *laevicauda* Le Conte, 59-252.  
     *horni* Kerremans, 96-324.  
 v. *bellporti* nov. var.  
*fasciferus* Schwarz, 78-363.  
*ærosus* (Melsheimer), 46-148.  
     *tessellatus* ‡ (Melsheimer), 46-148.  
 v. *rufescens* nov. var.  
*æruginosus* Gory, 41-335.

*Taphrocerus* Solier, 33-314.

- puncticollis* Schwarz, 78-363.  
*schaefferi* Nicolay & Weiss, 20-144.  
*agriloides* Crotch, 73-75.  
*laevicollis* Le Conte, 78-403.  
*gracilis* (Say), 25-252.  
     *alboguttatus* (Mannerheim), 37-120.  
     *cylindricollis* Kerremans, 96-312.  
     ? *texanus* Kerremans, 96-312.  
*albonotatus* Blatchley, 19-29.

(*Brachys pratexta* Gory is a manuscript name. The description was never published.)

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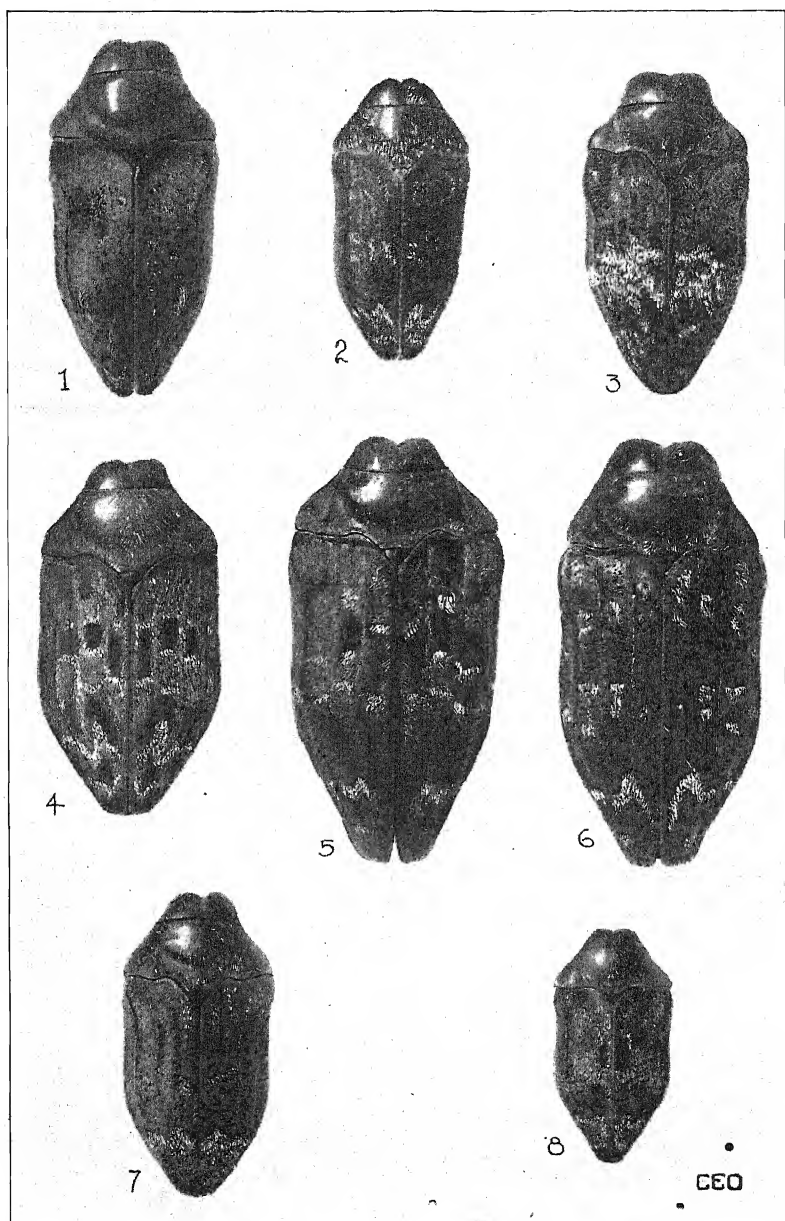
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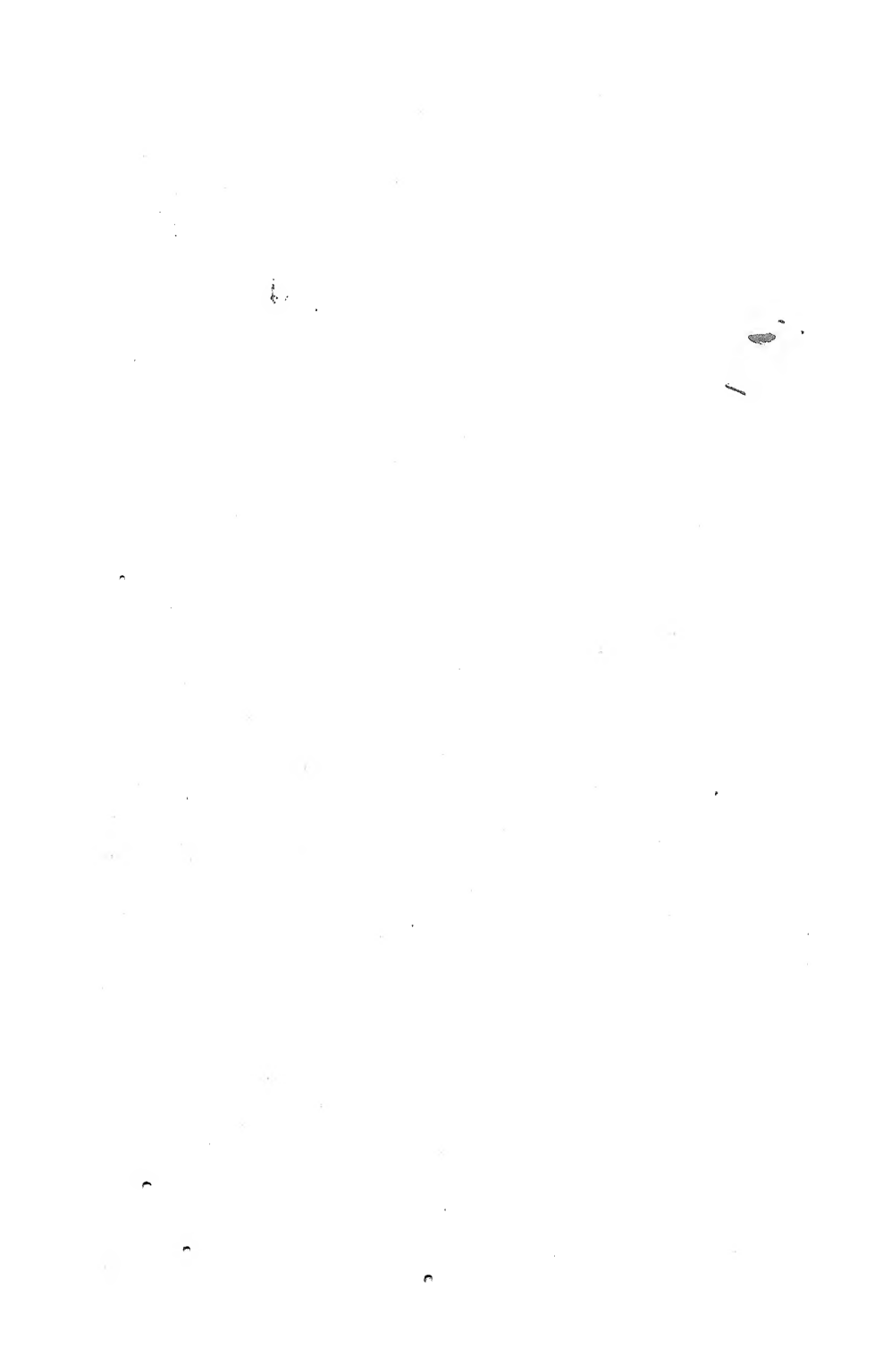
We take this opportunity to thank Mr. W. S. Fisher who not only secured several obscure references for us but also dissected many specimens in order to ascertain for a certainty, the peculiar sexual differences of some of the species. We are also very grateful to Mr. C. W. Leng, Mr. C. A. Frost, Mr. Frank R. Mason, Mr. Warren Knaus, Mr. Charles Schaeffer and Mr. Andrew J. Mutchler for placing their collections at our disposal and to Dr. Henry Skinner for granting us access to the Horn collection.

## EXPLANATION OF PLATE XI.

- FIG. 1. *Brachys floccosus*.  
FIG. 2. *Brachys cephalicus*.  
FIG. 3. *Brachys fasciferus*.  
FIG. 4. *Brachys floricola*.  
FIG. 5. *Brachys ovatus*.  
FIG. 6. *Brachys tessellatus*.  
FIG. 7. *Brachys arosus*.  
FIG. 8. *Brachys aruginosus*.



BRACHYS



## A PHYLOGENETIC COMPARISON OF THE MAXILLÆ THROUGHOUT THE ORDERS OF INSECTS.

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Since no comparative study of any structure, or set of structures, has been made in all of the insectan orders (considerations of the apterygotan orders, and of the apterous pterygotan orders, were naturally not included in the admirable studies of Comstock, Handlirsch, Tillyard, and others, who have sought to apply a uniform terminology to the wing veins of insects), I would present in the following discussion, the principal modifications of the maxillæ met with in the various insectan orders, including the Apterygota, as well as the wingless and winged Pterygota. Furthermore, since such a comparative study should always be made from the standpoint of phylogeny, I would also point out wherein the evidence of relationships gained from a study of the maxillæ is in complete accord with the conclusions regarding the interrelationships of insects reached through a study of the wings (*Can. Ent.*, 1922, LIV, p. 206), and other features of the body, used as a basis of comparison, thus furnishing further support of the correctness of these conclusions by means of confirmatory evidence from other sources.

The leg-like mouthpart-limbs of the Trilobita (which are just like the trunk limbs, in these forms) are of far too primitive a type to be the immediate precursors of the modified mouthpart-limbs which form the mandibles, maxillæ, and other trophi in insects; and, as I have pointed out in several papers (*Jour. N. Y. Ent. Soc.*, 1921, XXIX, p. 63; *Psyche*, 1921, XXVIII, p. 84; *Proc. Ent. Soc. of Washington*, 1922, XXIV, p. 65, p. 153, etc.), there must have been a long series of intermediate stages, before the insectan types were evolved—and the Crustacea are the only known forms, which furnish these necessary intermediate stages connecting the insectan types with the trilobitan, and other structurally primitive types.

The view which I have encountered everywhere, among American entomologists at least, is that the immediate precursors of the Insecta are the Chilopoda; but I must confess that despite my absolute will-



ingness to do so, I have been utterly unable to derive any of the structures of insects from chilopodan prototypes—and this naturally applies to the maxillæ as well as to the other structures of the body. Even the most cursory glance at the chilopodan maxilla shown in Fig. 16, for example, should convince anyone of the utter impossibility of deriving a typical insectan maxilla (such as the one shown in Fig. 4 or Fig. 5) from such a source—yet the chilopod maxilla shown in Fig. 16 is quite typical of chilopods in general, in all essential features! If we are to derive the insectan type of maxilla from some prototype or other, it is surely quite reasonable to demand that the prototype in question shall at least bear some faint resemblance to its supposed derivative, but I do not know of any chilopod whose maxillæ (or any other structures, for that matter) would fulfil these conditions—and even the symphylan and other “myriopodan” maxillæ figured by Latzel, 1880, Hansen, 1903, and others, would not serve as suitable prototypes for the typical insectan maxillæ. Among the Crustacea, on the other hand, we find some types of maxillæ and maxillipeds which are structurally just like the maxillæ of insects, while others of the Crustacea approach the types occurring in the lower arthropodan forms, and the Crustacea thus furnish not only the necessary prototypes of the structures of insects, but they also furnish the necessary (and only available) intermediate stages connecting insects with the lower Arthropoda—and a study of these Crustacea enables us to correctly interpret the homologies of the various structures occurring in insects.

If, then, instead of wasting our time in the fruitless contemplation of a chilopod's maxilla (Fig. 16) we compare a typical insectan maxilla such as the one shown in Fig. 4 with the crustacean maxilliped shown in Fig. 3 (which is essentially similar to the maxilla of the same crustacean, shown in Fig. 2) it is at once quite obvious that the cardo *cp* of the insect shown in Fig. 4 corresponds to the coxopodite *cp* of the crustacean shown in Fig. 3, while the stipes *bp*, with its lacinia *be*, of the insect shown in Fig. 4 corresponds to the basipodite *bp* with its endite *be* of the crustacean shown in Fig. 3. Similarly, the palpifer *ip* with its galea *ie* of the insect shown in Fig. 4, corresponds to the ischiopodite *ip* with its endite *ie*, of the crustacean shown in Fig. 3; and the four segments *me*, *crp*, *pp*, and *dp* of the maxillary palpus of the insect shown in Fig. 4,

correspond in every way to the four segments *me*, *crp*, *pp*, and *dp*, of the maxilliped palpus (or endopodite) of the crustacean shown in Fig. 3—and the remarkably close correspondence in these two classes of arthropods extends not only to the number of segments involved, but also to the relative proportions of the individual segments of the structures compared.

The terminal portion *dl* of the lacinia *la* of an insect such as the one shown in Fig. 26 (or in Figs. 21, 22, etc.) may be referred to as the distilacinia (the basal portion *bl* of the lacinia being the basilacinia) and this distilacinia in a number of primitive insects bears a fringe, or fimbrium, made up of several modified spine-like structures corresponding in a remarkable fashion to the modified seta or spine-like structures occurring at the tip of the second endite of various crustacean maxillæ (e.g., at the tip of the endite *ie* of Fig. 2). The remarkable correspondence in the minute details of the structures of the two groups of arthropods is at once apparent when we compare the fringe of the distilacinia of the insect shown in Fig. 24, with the fringe of the second endite of the crustacean shown in Fig. 25, in both of which there occur tooth-like "laciniadentes" labeled *a*, a longer "midappendix" labeled *b*, and pectinate "lacinulæ" labeled *le*. The "midappendix" labeled *b* in the crustacean shown in Fig. 17 is longer and more like that of the insect shown in Fig. 24 than is the case with the crustacean shown in Fig. 23; but the other parts of the fringe of the endite of the crustacean shown in Fig. 25 are more like the insect shown in Fig. 24 than is the case with the crustacean shown in Fig. 17.

The fringe or terminal structures labeled *a*, *b* and *le*, in the distilacinia of the Machilid insect shown in Fig. 15 are just like those bearing the same labels in the Podurid insect shown in Fig. 24 and the same types of structures occur in the terminal fringes of the distilacinia of other apterygotan insects such as the Entomobryid shown in Fig. 14, the Sminthurid shown in Fig. 8, the Sminthurid shown in Fig. 6, the Podurid shown in Fig. 12, etc., and even the Lepismatid insect shown in Fig. 9, has the marginal structures *a*, *b* and *le*. quite similar to those of the Entomobryid shown in Fig. 14 and the other Apterygota mentioned above. These parts in the Lepismatids and Machilids are so similar to those of the other Apterygota (and they are so different from the lacinial fringes of the maxillæ

of the Pterygota) that they lend additional weight to the many features which clearly indicate that the Lepismatids and Machilids (*i.e.*, the "Thysanura") are true Apterygota, and cannot be regarded as degenerate Pterygota, as Handlirsch and others are inclined to believe.

In addition to many other features of the body, the structure of the maxillæ of the Protura clearly indicates that the Protura are true apterygotan insects and that they are not very closely related to the "Myriopoda," as is claimed by certain investigators. If one compares the maxilla of the proturan shown in Fig. 22 with the maxilla of the "myriopod" shown in Fig. 16 it is at once apparent that there is no great similarity between the two, while on the other hand, if one compares the maxilla of the proturan shown in Fig. 22 with the maxillæ of the other apterygotan insects shown in Figs. 23, 21, 18, etc., the similarity is very striking. Thus the cardo *ca* of Fig. 22 is just like the cardo *ca* in Figs. 23, 21, 18, etc. The stipes *st*, with its lacinia *la*, of Fig. 22, is not essentially different from these structures in Figs. 18, 21, 23, etc., and the palpifer *pf*, with its galea *ga* of Fig. 22 is very similar to the palpifer *pf* with its galea *ga* in Figs. 23 and 21, while the maxillary palpus *mp* of Fig. 22 is quite like its homologue *mp* in Fig. 23. The evidence of the maxillary structures would therefore be in complete harmony with that furnished by other structures indicating that the Protura are true apterygotan insects.

As was mentioned above, the maxillæ of the Protura, Poduridæ, Sminthuridæ and Entomobryidæ are quite similar, and the evidence of the maxillary structures would be in harmony with the grouping of these insects into a proturoid division, (Panprotura) of the subclass Apterygota based upon the nature of the body in general in these insects.

The Japygidæ and Campodeidæ (*sensu lato*) are somewhat intermediate between the proturoid Apterygota mentioned above and the thysanuroid Apterygota; and the maxilla of *Japyx* (Fig. 23), for example, is more like the maxillæ of the proturoid insects (Figs. 22, 21, 18, etc.) than it is like the maxillæ of the thysanuroid insects (Figs. 26 and 10), in many respects—as is also true of the head and mouthparts in general of the Japygidæ and Campodeidæ. On the other hand, the presence in the Japygidæ and Campodeidæ of

cerci, styli, and other abdominal structures which are not developed in the proturoid insects makes me more inclined to group the Japygidæ and Campodeidæ with the thysanuroids than with the proturoids, although I would not insist upon this grouping and it would doubtless be more exact to place the Japygids and Campodeidæ in a group intermediate between the proturoids and thysanuroids. For the sake of convenience, however, I have grouped them in the thysanuroid division (Panthysanura), in the following discussion. The lacinial fringe, *le*, of *Japyx* (Fig. 23) is more like that of certain Lepismatid thysanuroids such as the Lepismatids related to *Nicoletia*, than it is to the lacinial fringe of the proturoids, and the galea and palpifer *ga* and *pf* of *Japyx* (Fig. 23) is more suggestive of the Lepismatids than it is of the proturoids, so that the maxillæ of the Japygidæ and Campodeidæ may be said to be intermediate between the proturoid and thysanuroid types in some respects. The maxillary palpus was omitted in the drawing from which Fig. 13 was made but a comparison of the maxilla of *Campodea* shown in Fig. 13 with the maxilla of *Japyx* shown in Fig. 23 very clearly indicates that *Campodea* and *Japyx* are members of the same order of insects as is also borne out by a study of the structural details of the body in general so that the orders Rhabdura and Dicellura (in which the Campodeidæ and Japygidæ are frequently placed) should be merged into one.

*Machilis* (Fig. 26) is an extremely primitive thysanuroid insect, and in its maxilla the palpifer *pf* retains its primitive condition as a distinct segment not yet united with the stipes *st*, which is very like the stipes of the proturoids (Fig. 18, 21, 22, etc.) in its general character. The lacinial fringe labeled *a*, *b*, and *le*, in the *Machilid* shown in Fig. 15 is also strikingly similar to these structures in the proturoid insect shown in Fig. 24 and the huge development of the maxillary palpus *mp* (which, however, is composed of seven segments—a most unusual number) probably denotes the retention of a very primitive condition. These features are in harmony with many other facts which indicate that the *Machilidæ* are much more primitive insects than is usually supposed to be the case, and they have preserved a number of characters present in the ancestral insects, very suggestive of their crustaceoid prototypes. The *Machilidæ* also approach the Lepismatidæ quite closely (Fig. 10), and the

Lepismatidæ are very like the forms giving rise to the pterygotan insects, in many respects.

The maxillæ of the Lepismatidæ (Fig. 10) are astonishingly like the maxillæ of certain lower Pterygota, and in fact are more pterygotan than apterygotan in character (although this is not true of the maxilla of *Machilis* shown in Fig. 26, which is also a thysanuroid apterygotan). Thus the cardo, *ca*, of Fig. 10 tends to become divided into two sclerites *bc* and *dc*; the palpifer *pf* tends to unite with the stipes *st*, which thus appears to bear both galea *ga* and lacinia *la*; the lacinia *la* is quite pterygotan in character, and the number and relative proportions of the segments of the maxillary palpus *mp* of the insect shown in Fig. 10, are strikingly pterygotan. The fringe of the lacinia of the Lepismatid insect shown in Fig. 7 is also very like that of the pterygotan insect shown in Fig. 47, especially in the nature of the appendage *b*. On the other hand, the structures *a*, *b* and *le* of the lacinial fringe of the Lepismatid insect shown in Fig. 9 are more apterygotan (compare with Fig. 14), and taking the structure of the body as a whole, the Lepismatids are much nearer to the Machilids than they are to the Pterygota—and the Machilids are “out and out” Apterygota. When we take all of their structures into consideration, the Lepismatids are also more apterygotan than pterygotan, but in their maxillæ and certain other features, they furnish excellent annectant forms connecting the Apterygota with the Pterygota.

In comparing the maxillæ of the Pterygota, I shall have occasion to refer to areas and subdivisions which are possibly not familiar to anyone who has not made a special study of the maxillæ of insects, and on this account it may be well to briefly describe the principal parts of a typical pterygotan maxilla. For this purpose the maxilla of the orthopteran *Gryllus* (Fig. 33) will serve as well as any to illustrate the main features of value in comparing the various pterygotan types.

The cardo of *Gryllus* (Fig. 33) is composed of a basal area or basicardo *bc*, and a distal area or disticardo *dc*, and in addition to these, there may occur a cardomarginal area *cm*, which, however, is of no great importance, from the standpoint of comparative anatomy, while the basicardo and disticardo occur in long series of insects extending even to the higher Pterygota. The first desig-

nations to be applied to the areas *bc* and *dc* were the terms "paracardo" and "eucardo" (Psyche, XXIII, 1916, p. 83); but it is preferable to apply the designations basicardo and disticardo to these areas in all insects. As shown by DuPorte, 1920, and others, the basicardo is connected with the tentorium by a tentorio-basicardine muscle, and the disticardo is connected with the tentorium by a tentorio-disticardine muscle, both of which serve as adductors ("closers") of the maxilla. The cardo usually articulates with the hypostomal region of the head capsule by means of a cardocondyle *cc*; and a condylar groove in this area of the cardo usually receives a ridge or projection of the margin of the hypostomal region of the head capsule. The cardoprocess *cpr* is a process of the basal portion of the cardo to which muscles are attached by means of the cardotendons *ct*—such, for example, as the gena-cardotendon and postgena-cardotendon muscles, which serve as abductors ("openers") of the maxillæ by pulling down upon the cardoprocess, while the cardocondyle *cc* serves as fulcrum. Internally, the division of the cardo into a basicardo and disticardo is frequently marked by a transcardo plica or transverse infolding of the integument of the cardo, forming an internal ridge-like structure to which the adductor muscles may be attached. This division of the cardo into a basicardo and disticardo (*bc* and *dc* of Fig. 33) may possibly correspond to the division of the basal segment *cp* of the crustacean maxilla shown in Fig. 2; but this point has not as yet been definitely determined. A cardomarginal plica demarks the cardomarginal region internally.

The stipes forms the main portion of the "body" of the maxilla, and the palpifer *pf* tends to unite with it more or less closely in the Pterygota. The stipes is divided into a true stipes, or eustipes, *eus*, and a parastipes, *pas* (first defined in Psyche, 1916, p. 83), and this division persists in many types of insects. An internal parastipital plica or infolding of the integument along the line demarking the parastipes *pas* forms an internal ridge to which the tentorio-parastipital muscles (extending from the parastipital region to the tentorium, and serving as flexors ("closers") of the maxillæ, may be attached. The parastipes *pas* of Fig. 33 may possibly correspond to the narrow chitinated region *pas* of Fig. 2; but this again is pure speculation. The eustipes *eus* of Fig. 33 may be divided into a

basal region *bs* or basistipes, a distal region *ds* or dististipes, and a median region or mediostipes, labeled *ms* in Fig. 35, by the formation of sutures in the region *eus* of Fig. 33 (in which the beginnings of the formation of these sutures can be detected, while they have become completely formed in Fig. 35). Fig. 36 presents an intermediate condition in which the parastipital region *pas* (which is distinct in Fig. 33) tends to unite with the median region *ms* to form the larger median region *ms* of Fig. 35. A stipito-lacinial muscle from the stipes to the tendon at the base of the lacinia serves to flex the lacinia, while a stipito-galeal muscle from the stipes to the galea serves to flex the galea, and stipito-palpal muscles from the stipes to the basal segment of the maxillary palpus aid in extending and flexing the palpus. It is possible that the tension of the above mentioned muscles may play some rôle in the division of the eustipes into areas, but this is not very probable.

The lacinia may bear apical laciniadentes *ld* or tooth-like processes for holding and comminuting the food, and the appendage labeled *b* in Fig. 33 may be a modified tooth-like appendage, or a modified "lacinula" such as occur on the lacinia of such insects as the one shown in Fig. 24 (*i.e.*, the structures labeled *le* in Fig. 24—of which the structure labeled *b* in Fig. 24 may be a modification). At any rate, the structure labeled *b* in Fig. 33 appears to be homologous with the structure bearing the same label in Fig. 47. The lacinia-fimbrium or fringe of hair-like, bristle-like, or spine-like structures bordering the lacinia has not been figured in most cases, since it is not very important for the purpose of demonstrating the affinities of the insects compared.

The galea is divided into a basal segment or basigalea *bg* and a distal segment or distigalea *dg* (first so designated in Psyche, 1916, p. 83) in Fig. 33, and this division of the galea into two segments occurs in a wide series of insects. The distal segment of the galea frequently bears a galeal sensarea, or sense area which usually remains membranous and is provided with sensory organs in many insects. The distal segment of the galea bears a galeafimbrium or fringe in many coleopterous, neuropterous, and mecopterous insects, and the fringe of the galea and that of the lacinia are frequently modified for feeding purposes.

The maxillary palpus is usually five-segmented, with the basal two

(basimeres) small and subequal; the third (intermere) is frequently long, and the distal two (distimeres) are usually somewhat shorter, and subequal in size. The terminal segment of the maxillary palpus frequently bears at its tip a palpal sensarea which is usually membranous and richly provided with sense organs. Endomerale flexor and extensor muscles (within the palpal segments) serve to flex and extend the maxillary palpus.

Some of the modifications of the maxillæ in the various pterygotan orders are as follows. The cardo of a typical Odonatan (Fig. 30) is divided into basicardo and disticardo (*bc* and *dc*); but the parastipital region is not clearly demarked from the remainder of the stipes in most cases. The lacinia frequently bears numerous tooth-like processes, and the galea shows traces of two segments in many cases. The maxillary palpus is wanting in all of the Odonata I have examined (unless the structure here interpreted as the galea is in reality the maxillary palpus—in which case there is no galea), and this is possibly characteristic of the order.

In the Ephemera (Fig. 31) the cardo may show traces of a division into basicardo and disticardo, and the stipes may show indications of a division into eustipes and parastipes, although I am not certain that the area labeled *pas* in Fig. 31 is strictly homologous with the areas bearing this label in other figures. In all of the Ephemera which I have been able to examine, the galea and lacinia appear to unite to form a single maxillary "mala"; but in the naiads of the primitive New Zealand ephemerid *Oniscigaster* (Fig. 31) collected by Dr. J. W. Campbell and turned over to me to study by Dr. C. P. Alexander, the mala of the maxilla is divided by a well-defined suture which I have interpreted as the line of demarcation between the uniting galea *ga* and lacinia *la*. The union of the galea and lacinia is possibly characteristic of the order Ephemera.

Certain ephemerid naiads (*i.e.*, immature forms) exhibit tooth-like processes of the lacinia very suggestive of those occurring on the lacinia of certain Odonata (Fig. 30); but the maxillæ of the Ephemera are not as similar to those of the Odonata as might be expected from the fact that the Ephemera and Odonata may be grouped in a superorder (Panarchiptera) on other grounds. The maxillæ of the Odonata are decidedly aberrant, and the same is true, to some extent, of the maxillæ of the Ephemera, so that the general aberrant



nature of the insects in question may account for the lack of similarity between the two groups in certain features.

As may be seen in Fig. 1 the insects next above the thysanuroids are the palæodictyopteroid insects comprising the archaic Pterygota (division "Archipteradelphia") which include the Palæodictyoptera with their immediate relatives, together with the Prodonata, Odonata, Protephemerida and Ephemerida. In most of these insects the fore and hind wings are alike (homonomous), and they are unable to lay the wings flat along the top of the abdomen when at rest. Since they are among the most primitive of the Pterygota in many respects, I was much disappointed to find that the maxillæ of the Ephemerida and Odonata are rather highly modified, so that the evidence of the maxillæ alone would not indicate the true primitive nature of the insects in question, and we are dependent upon other features to determine their position in the scale of development indicated in Fig. 1.

The orthopteroid insects which are accorded the position immediately above the palæodictyopteroids in Fig. 1 constitute the division Orthopteradelphia, or lower pterygotan insects (the palæodictyopteroids constitute the archaic pterygotan insects). These orthopteroid insects or lower Pterygota tend to exhibit a heteronomous condition of the wings (*i.e.*, fore wings differing from the hind ones) due to the tendency toward the development of an anal fan in the hind wings. The wings are capable of being laid flat along the back of the abdomen.

The orthopteroid insects may be divided into three superorders called the Panplecoptera (comprising the Plecoptera, Embliids, and their immediate relatives), the Panorthoptera (comprising the Orthoptera, in the restricted sense, the Protorthoptera, the Phasmids, and the Dermaptera, with their immediate relatives) and the Panisoptera (comprising the Protoblattids, Blattids, Mantids, and the Isoptera, with their immediate relatives). Of these, the Panorthoptera and Panisoptera may be regarded as a single superorder; but for the sake of convenience, I shall treat them as separate groups in the following discussion. All of these insects are derived from the common Protoblattid-Protorthopteran stem, and hence exhibit marked intergradations making it very difficult to determine where to draw the dividing line separating them into definite groups.

The maxillæ of the Panplecoptera (Plecoptera, Embiids, etc.) are not as similar as one would expect from the marked similarity in wing-venation, terminal structures of the male insects, character of the thoracic sclerites and other features in the Embiids and Plecoptera, for example; but the character of the galea *ga* in the primitive Plecopteran shown in Fig. 44 (which was given to me by Dr. Tillyard) is very similar to the one of the Embiid shown in Fig. 40 (drawn from specimens collected by Dr. Wheeler and Dr. Bailey), and the nature of the lacinia *la* is practically the same in both Figs. 44 and 40. The cardo *bc* and *dc* is rather slender and elongate in both; but other than in the features mentioned above the Embiids and Plecoptera are disappointingly unlike in the general character of their maxillæ.

In the slenderness of their lacinia *la* and galea *ga*, the Plecoptera shown in Figs. 44 and 46 are rather suggestive of the Dermaptera (Fig. 35), and the Plecopteran shown in Fig. 46 has a small terminal micromere *mm* similar to the micromere *mm* at the tip of the palpus of the Dermapteran shown in Fig. 35. The slender basigalea *bg* and distigalea *dg* of the Plecopteran shown in Fig. 46 are suggestive of the slender basigalea *bg* and distigalea *dg* of the Coleopteran shown in Fig. 37, and the formation of a chitinated plate or basimaxilla *bm* in the basimaxillary membrane at the base of the maxilla of the Plecopteran shown in Fig. 44 is also suggestive of the basimaxilla *bm* of the Coleopteran shown in Fig. 5. A similar basimaxillary plate *bm* occurs in the Isopteran shown in Fig. 45. The maxillæ of the Plecoptera therefore exhibit similarities to those of the Embiids, Dermaptera, Coleoptera, and Isoptera, and they are also suggestive of the maxillæ of the true Orthoptera such as those shown in Figs. 41, 34, etc. These facts are quite in harmony with the evidence from other sources which indicates that all of the forms in question are descended from the common Protorthopteran-Protoblattid stock. From this same stock the Phasmids were derived, and this probably accounts for the resemblance between the maxillæ of the Embiids (Fig. 40) and the Phasmids although the primitive Phasmid shown in Fig. 39 (drawn from a specimen given me by Dr. Ferris) does not illustrate this marked resemblance between the Phasmids and Embiids as well as might be desired.

The maxillæ of the Panorthoptera (*i.e.*, true Orthoptera, Phasmids,

Dermaptera, etc.), present some features of considerable interest from the standpoint of the origin of the higher Pterygota such as the Coleoptera, etc., and the hints which they offer are of considerable value. As was mentioned in the preceding discussion, the Gryllid shown in Fig. 33 illustrates the beginning of the breaking up of the eustipes *eus* into a basistipes *bs*, a dististipes *ds*, and a mediostipes *ms* which is still distinct from the parastipes *pas* in Fig. 34, but unites with it to form the enlarged mediostipes *ms* of Fig. 35. In the Dermapteran shown in Fig. 35, and the Orthopteran shown in Fig. 34 we clearly have the prototypes of the coleopterous maxillæ such as those shown in Figs. 37 and 36, in so far as the formation of the peculiar sclerites *pf*, *bs*, *ms* and *ds* is concerned (a condition occurring in no other insects so far as I am aware), and the marked similarity in these peculiar features clearly indicates that the Coleoptera, Dermaptera and Orthoptera sprang from common ancestors which were very like the ancestral Protorthopteran-Protoblattid stock which gave rise to the Orthoptera and Dermaptera (as well as to the Plecoptera and Embiida) at a lower level than that at which the Coleoptera branched off. The striking similarity in the character of the cardo, stipital region, slender galea and lacinia, etc., of the insects shown in Figs. 34 and 35 is clearly in harmony with the evidence from other sources (such as the nature of the thoracic sclerites and appendages, cerci, etc.) pointing to the Orthoptera as the nearest relatives of the Dermaptera; and the two groups apparently sprang from a common source in the common Protorthopteran-Protoblattid stock. The character of the cardo and the long narrow palpifer *pf*, together with the presence of a micro-mere *mm* at the tip of the maxillary palpus are features which add to the evidence from other sources pointing to the fact that the Hemimeridæ (Fig. 28) are merely modified Dermaptera (Fig. 35).

The maxilla of the very primitive Orthopteran *Grylloblatta* shown in Fig. 41 (which was drawn from a specimen loaned by Dr. Walker) gives some evidence that at a very early stage of Orthopteran development there occurred a slender lacinia *la* which was not overtopped by the slender galea *ga* (in which respect the maxillæ of the primitive Orthoptera were doubtless more like that of the Plecopteran shown in Fig. 44, than they were like the maxillæ of the Blattid shown in Fig. 47); and this primitive condition is also re-

tained by the Dermapteron shown in Fig. 35 and the Orthopteron shown in Fig. 34. On the other hand, the galea *ga* of the Phasmid shown in Fig. 57 (which is a close relative of the primitive true Orthoptera) is broad and overtops the broad lacinia *la* as in the Blattids (Fig. 47) and their allies. The character of the cardo, stipital region, lacinia and galea of the maxilla of *Grylloblatta* would lend weight to the view that it is closely related to the true Orthoptera (Figs. 34, 33, 42, etc.) rather than to the claim made by other investigators who would place *Grylloblatta* nearer the Blattids and Mantids (Figs. 47 and 48). The maxilla of the Tridactylid (shown in Fig. 42) with its peculiar sclerite *lf* immediately proximal to the lacinia *la* is strikingly similar to the maxilla of the Tettigid shown in Fig. 43, thus lending further support to the view that the Tridactylidæ are much more closely allied to the Tettigidæ than they are to the Gryllidæ (as some investigators claim). The maxillæ of the Gryllidæ (Fig. 33) are very like the maxillæ of the Tettigoniidæ (the old "Locustidæ") such as the one shown in Fig. 32, and the maxillæ of the Tettigoniidæ are somewhat more like those of the "Acrididæ" (or Locustidæ, as they are now called) than the Gryllid maxillæ are. The maxillæ of some primitive Phasmids (Fig. 39) are more like those of the true Orthoptera, while the maxillæ of other Phasmids (Fig. 57) are somewhat more like those of the Blattids and Mantids (Figs. 47 and 48), thus lending weight to the view that the Phasmids are in a measure annectant between the Blattid-like forms and the true Orthoptera (and the lower phasmids, such as the one shown in Fig. 39, also approach the Embiid type shown in Fig. 40, thus indicating the synthetic nature of the Phasmids).

In the maxillæ of the Panisoptera (Blattids, Mantids, Isoptera, etc.) the galea *ga* is usually large and "fleshy" and overtops the lacinia *la*. The maxillæ of the Blattids (Fig. 47) are so like those of the Mantids (Fig. 48) that this would indicate that these insects should be grouped in a single order. The persistence in the Blattid shown in Fig. 47 of the pectinate "midappendix" labeled *b*, which occurs in certain apterygotan insects such as the one shown in Fig. 7, is a very primitive character; but the homologue of the structure labeled *b* in Fig. 47 probably also occurs in certain other members of the lower Pterygota (*e.g.*, Fig. 46, Fig. 33, etc.). The Isopteron

shown in Fig. 45 is not as much like the Blattids and Mantids shown in Figs. 47 and 48 as one would expect. The presence in the Isopteron shown in Fig. 45 (drawn from a specimen given me by Dr. Bequaert), of the basimaxilla *bm* is a feature suggestive of the Plecopteron shown in Fig. 44, and a similar basimaxillary plate *bm* occurs in the coleopterous larva shown in Fig. 5. The maxillæ of the Isoptera would bear out the conclusion that the Isoptera are the representatives of the superorder Panisoptera which are approached the most closely by the members of the other superorders (such as *Grylloblatta* (Fig. 41), etc., among the Panorthoptera, *Oligotoma* (Fig. 40) among the Panplecoptera, etc.) and this is probably due to the fact that the Isoptera are as near as any Panisoptera are to the Protorthoptera, whose line of development is paralleled by that of the other superorders in question. The evidence of the maxillæ of the insects in question would be in harmony with that from other sources, which indicates that the Blattids, Mantids and Isoptera are the descendants of the common Protorthopteran-Protoblattid stock from which the other lower Pterygota were also derived (*i.e.*, they branched off at the point where the common Protorthopteran-Protoblattid stock began to diverge from the Palæodictyoptera).

The so-called higher Pterygota (Neuropteradelphia) are characterized by the fact that the wings are heteronomous, the fore wings being usually larger than the hind ones, and the wings are either laid flat along the abdomen when at rest or are held "roof-like" over it, in most cases. There are two principal superorders of higher Pterygota. These are the Panhemiptera (Hemiptera with the Homoptera, Psocids, Mallophaga, Pediculids, etc.) and the Panneuroptera which include the Neuroptera, Coleoptera and Hymenoptera, etc., together with a group of higher Neuropteroids composed of the Mecoptera, Diptera, Siphonaptera, Lepidoptera, Trichoptera, etc. These higher Neuropteroids have been grouped in a separate superorder, the Panmecoptera; but it might possibly be preferable to include them in the superorder Panneuroptera rather than place them in a distinct superorder.

Among the Panhemiptera (Psocids, Mallophaga, Anopleura, Hemiptera, etc.) the Psocids have retained the maxillæ in the most primitive condition occurring in the superorder, thus bearing out the

evidence from other sources that the Psocids have departed as little as any from the condition approximating the original one for the superorder. In a previous paper (Can. Ent., 1922, LIV, p. 206) the Zoraptera were placed in the order Psocida (Parahomoptera) on account of the great similarity of the wings, head capsule, legs, testes, and other structures of the Zoraptera to those of the Psocids. I must admit, however, that the maxilla of a Zorotypid (suborder Zoraptera) such as the one shown in Fig. 38 (which was made from a specimen given me by Mr. Caudell) is of a much more primitive type than the maxilla of any other Psocid I have been able to find (*e.g.*, the one shown in Fig. 73 is typical of the Psocids in general). In fact, the maxilla of the Zorotypid shown in Fig. 38 is as "orthopteroid" as any of the higher insects, and on this account, I have placed the Psocoid insects (*i.e.*, the Psocids, Mallophaga, etc.) immediately above the "orthopteroids" in Fig. 1. The maxilla of the Zorotypid shown in Fig. 38 is very similar to that of the Phasmid shown in Fig. 39 and resembles the maxilla of the Embiid shown in Fig. 40 extremely closely. This resemblance is in harmony with the evidence of the wing veins, for example, which indicate that the Zoraptera were derived from Protorthoptera-like forbears closely allied to those from which the Embiids were derived, and the Phasmids were probably descended directly from Protorthopterous forbears. The Zorotypids approach the Isoptera in many respects, and one would expect that the maxilla of the Zorotypid shown in Fig. 38 would be more like that of the Isopteron shown in Fig. 45 than is the case. There is some resemblance between the two maxillæ, however, and this is probably due to the mutual relationship of the Zoraptera and Isoptera to the Protorthoptera (or to the Protorthopteran-Protoblattid stem from which both were descended).

The maxillæ of the Psocids (Fig. 73) are strikingly similar to those of the Mallophaga (Fig. 74), thus strongly supporting the view that the Mallophaga were descended from Psocid-like ancestors. As has been suggested by others, the stylet-like structure labeled *la* in Fig. 73 may represent the lacinia and if the structure labeled *la* in Fig. 73 is the lacinia, the structure labeled *la* in Fig. 74 must be the lacinia also. It is likewise quite probable that the structure labeled *la* in Fig. 72 is homologous with the structure labeled *la* in Figs. 73 and 74, and the maxillæ of the Thysanoptera (Fig. 72) ap-

proach those of the Psocids (Fig. 73) quite closely in their general features, thus adding further weight to the view that the Psocids and the Thysanoptera were descended from common forbears closely allied to the Protorthoptera. The mouthparts of the Anoplura (Fig. 76) are too highly specialized to offer any very serviceable clews as to immediate relatives of the group. The maxillæ of the Anoplura, however, are as near to those of the Mallophaga as any, and the nature of the mouthparts would not preclude their derivation from ancestral types related to the Mallophaga and Psocids—an ancestry which is indicated by other features of the body in general.

Although the Hemiptera appear to have lost them completely, the maxillary palpi are retained in both Thysanoptera (Fig. 72) and Psocids (Figs. 73 and 38), and the galea *ga* and stipites *st* of these insects are much more primitive than the structures labeled *ga* and *st* in the Homopteron shown in Fig. 75 (drawn from a specimen given me by Mr. Gowdey); and the evidence of the maxillary structures would indicate that the Psocids have departed much less than the Homoptera have from the ancestral condition of the Psocoid insects in general, although the phenomena of heterarchaism or heterospecialization (*i.e.*, the unequal primitiveness or specialization of the different parts of an organism, which frequently preserves some structures in a relatively primitive condition while other structures in the same individual may be rather highly specialized) make it very difficult to determine which insects are the more primitive when such unequally specialized forms are compared. The structure labeled *la* in Fig. 75 appears to be homologous with the structure labeled *la* in Fig. 73, and possibly represents the lacinia in which the basal portion has become invaginated to form a chitinous cup below the surface of the integument of the head capsule. The curled drum-like basal portion of the structure labeled *la* in Fig. 75 apparently represents the basal portion of the newly forming lacinia which fits into the old lacinia *la* of the nymph, in the fashion described by Snodgrass, 1922, in the cicada. The evidence of the maxilla would be in harmony with that from other sources indicating that the Hemiptera (with the Homoptera) were derived from ancestors which were the same as, or were very like those of the Psocids; and the grouping of the Psocids, Mallophaga, Anoplura and Hemiptera (with the Homoptera) into the superorder Panhemiptera is apparently a natural one.

The Coleoptera, Strepsiptera, Hymenoptera and Neuroptera with their allies form the Neuropteroid superorder Panneuroptera; and it is largely a matter of personal preference whether we restrict the superorder Panneuroptera to these forms or also include in the superorder Panneuroptera the higher Neuropteroids such as the Trichoptera, Lepidoptera, Mecoptera, Diptera, Siphonaptera and their allies (which might be grouped in a superorder Panmecoptera distinct from the rest of the Neuropteroids or holometabolous insects).

In some respects the Coleoptera are among the most primitive of the Neuropteroid insects, and as was pointed out above, their maxillæ (Figs. 36 and 37) are strikingly similar to those of the Dermaptera (Fig. 35) and Orthoptera (Fig. 34), and even such highly modified parasitic Coleoptera as the Platypyllids (Fig. 29) and Leptinids (Fig. 27) appear to be modified along paths of specialization presaged in the parasitic Dermaptera of the family Hemimeridæ (Fig. 28). In this connection it should be remarked that the maxillæ of the Platypyllids and Leptinids (Figs. 29 and 27) are so similar that, in addition to other features (such as the character of the head and body in general), the evidence of the maxillæ, etc., leaves no room for any doubt that both groups are anything else than modified Coleoptera (the generally accepted view), as I found out when I was able to compare specimens of both families loaned me by Dr. Cooley and Dr. Boving. It is not beyond the range of possibility that these two Coleopterous families have not departed far from the types which give rise to the Mallophaga and other Psocid-like forms, since the order Coleoptera took its origin very near the point at which the line of development of the Psocid-like forms arose from ancestors resembling the Protorthoptera, although the ancestors of the Coleoptera were identical with or very similar to the forms which gave rise to the Neuroptera (and occupied a position at the point where the common stem of the Protorthoptera and Protoblattida began to diverge from that of the Palæodictyoptera). The line of development of the Coleoptera is a rather aberrant one; but their nearest relatives appear to be the Neuroptera and Hymenoptera, and the maxillæ of certain Coleopterous larvæ are strikingly like those of certain lower Neuropterous larvæ (as may be seen by comparing Fig. 5 with Fig. 4, although the larvæ there shown are not the best fitted for illustrating the striking resemblance between the Coleoptera and Neuroptera).



The galea *ga* of the Neuropteran shown in Fig. 50 is rather slender and is divided into a basigalea *bg* and a distigalea *dg* suggestive of the condition exhibited by such Coleoptera as the one shown in Fig. 37; and, although this is not true of all Neuroptera (*e.g.*, the one shown in Fig. 49) there is a tendency in the Neuropterous maxillæ for the cardo to become quite slender (Figs. 50 and 51) and for the maxilla as a whole to depart rather widely from the Orthopterous type. The elongation of the maxillæ in the Neuroptera is apparently accomplished by the lengthening of the stipes *st* of Fig. 51, and of the lacinia *la* and galea *ga* which become long slender organs in the Neuropteran shown in Fig. 51. The lacinia *la* of the Neuropteran shown in Fig. 51 is longer than the galea *ga*, which is a rather unusual condition among insects in general; but a comparison with the other Neuroptera shown in Figs. 50 and 49 very clearly indicates that the structure labeled *la* in Fig. 51 is the true lacinia, and the structure labeled *ga* is the entire galea, which is divided into a basal and distal region (*bg* and *dg*) as in the Neuropteran shown in Fig. 50. When the cardo is long and slender in the Neuroptera (as in Figs. 50 and 51), it is still so oriented that its basal end is directed inward or toward the median plane of the body (*i.e.*, the maxilla is endocardine); but in the Hymenoptera, when the cardo is long and slender (as in Figs. 54, 55, and 56), its basal end is usually directed outward, or toward the lateral region of the body (*i.e.*, the maxilla is exocardine). In this respect, the maxillæ of even such primitive Hymenoptera as the one shown in Fig. 54, are rather highly specialized. In the very primitive Hymenopteran shown in Fig. 58 (which was drawn from specimens given me by Mr. Rohwer and Mr. Middleton), however, the cardo is more "normal."

In the Hymenoptera shown in Figs. 58 and 59, the galea *ga* is partially split into an inner lobe *eng* or endogalea and an outer lobe *exg* or exogalea; and this division into two lobes *exg* and *eng* apparently occurs in the galea *ga* of the Phasmid shown in Fig. 57 also. The Hymenoptera (together with the Neuroptera and Coleoptera) were apparently derived from ancestors in or extremely closely allied to the common Protorthopteran-Protablattid stock which gave rise to the Phasmids (and Isoptera also), and it is quite possible that both Hymenoptera (Fig. 58) and Phasmids (Fig. 57) may have inherited from a common source, the tendency for the galea *ga* to split into

the external and internal lobes *exg* and *eng*; but this is pure speculation. At any rate, the Hymenoptera and the Phasmids are the only insects in which this tendency is exhibited, so far as I am aware, and I am unable to determine whether this tendency in the two orders is due merely to convergence or not. In many of the higher Hymenoptera, the lacinia *la* is greatly reduced (Figs. 55, 56, etc.), and the galea *ga* becomes folded upon itself, in some instances giving the appearance of the folds becoming adherent to each other so closely as to produce a more or less complete fusion of originally separate lobes. Whether these adhering lobes have any particular relation to the small lobes *exg* and *eng* of Fig. 58, is not clear. The maxillary palpi of certain of these higher Hymenoptera, such as the one shown in Fig. 54 or Fig. 55, appear to be composed of more than the usual five segments, and taken all in all, the maxillæ of the Hymenoptera exhibit the most remarkable specializations I have found among insects (with few exceptions).

For the sake of convenience, I shall refer to the higher Neuropteroids (*i.e.*, the Trichoptera, Lepidoptera, Mecoptera, Diptera, Siphonaptera, and their immediate relatives) as the "Panmecoptera," grouping them in a superorder distinct from the lower Neuropteroids or Panneuroptera (*i.e.*, the Neuroptera, Coleoptera, Strepsiptera, and Hymenoptera, with their immediate relatives), since the higher Neuropteroids are more closely related to each other than they are to the lower Neuropteroids, although they naturally intergrade with the lower forms; and the superorder Panneuroptera might be made to contain them also in a natural assemblage of holometabolous insects. It is very difficult to determine which of the higher Neuropteroids is the most primitive, since the Trichoptera have retained a very primitive type of venation in some instances (particularly in the anal region of the hind wings), and the maxilla of such Lepidoptera as the one shown in Fig. 77 is as primitive as any I have been able to find among the higher Neuropteroids; but taking their anatomy as a whole, the Mecoptera are doubtless the most primitive representatives of the higher Neuropteroids (Panmecoptera).

The maxilla of the primitive Mecopteron shown in Fig. 53 is quite "orthopteroid" in many respects, and it bears some resemblance to the maxilla of the Embiid shown in Fig. 40. In those Mecoptera in which the cardo is slender and elongate, as in Fig. 70 (drawn from

a specimen given me by Dr. Tillyard), the cardo is turned outward (*i.e.*, the exocardine position obtains); but in most Mecoptera, the cardo is not elongate, and is turned inward (*i.e.*, the maxillæ are endocardine) as in Figs. 52, 53 and 60. Lengthening of the maxilla is usually accomplished by the lengthening of the stipes *st* which may be accompanied by a lengthening of the galea *ga* and lacinia *la* as in Fig. 52, or the galea and lacinia may not take part in the process, as in Fig. 60.

The Mecoptera approach the Hymenoptera in so many features that one might be led to think that the structures labeled *ga* and *la* in Fig. 60, instead of representing the galea and lacinia (as the labels would indicate), should be interpreted as representing the divided lobes *eng* and *exg* of the galea *ga* of the Hymenoptera shown in Figs. 59 and 58. That this view is entirely untenable, I am convinced for the following reasons. The structures labeled *ga* and *la* in the Mecopteron shown in Fig. 60 are entirely homologous with the structures labeled *ga* and *la* in the Mecoptera shown in Figs. 53 and 52, and what applies to one applies to all. If one compares the structures labeled *ga* and *la* in the primitive Mecopterous maxilla shown in Fig. 53 with the structures labeled *ga* and *la* in the primitive Hymenopteron shown in Fig. 54, or with the Embiid shown in Fig. 40, it is at once evident that the structures bearing the labels *ga* and *la* in all three insects are entirely homologous, and represent the galea and lacinia in all of them, including the Mecopteron shown in Fig. 53. Similarly, if one compares the structures labeled *ga* and *la* in the Mecopteron shown in Fig. 52 with the parts bearing the same labels in the Neuropteron shown in Fig. 51, it is quite apparent that the structures are entirely homologous in both, hence the structures labeled *ga* and *la* in Fig. 52 must represent the galea and lacinia, since their exact homologues *ga* and *la* in Fig. 51 represent the galea and lacinia, as may be seen by running back in the series of Neuroptera shown in Figs. 51, 50 and 49.

The evidence of the maxillæ would indicate that certain Neuroptera (Fig. 51) approach certain Mecopterous types (Fig. 52) more closely than is true of any other insects, and the evidence of the venation of the wings would also strengthen this view. On the other hand, the nature of the male reproductive organs and certain other features would indicate that the Hymenoptera also approach the Mecoptera very closely in many respects, and the type of Hymenopterous maxilla shown in Fig. 69 is very like that of the Mecopteron shown in Fig.

70 thus lending further weight to the latter view. I even find some features in certain Coleoptera which strongly suggest a close relationship to the Mecoptera; and all of these resemblances are doubtless due to the fact that the Mecoptera are descended from the same ancestors which gave rise to the lower Neuropteroids such as the Coleoptera, Neuroptera and Hymenoptera. As far as the maxillæ are concerned, the Neuroptera (Fig. 51) and Hymenoptera (Fig. 69) approach the nearest to the Mecopterous types (Figs. 52 and 70); although the tendencies exhibited by certain Coleoptera even in the maxillæ (Fig. 68) are not very different from those exhibited by the Mecoptera and Hymenoptera shown in Figs. 70 and 69.

Practically all of the structures of the Mecoptera are strikingly similar to those of some Diptera, and the evidence of the maxillæ bears out the relationship indicated, in a remarkable manner. Thus in the Dipteron shown in Fig. 71 and the Mecopteron shown in Fig. 70, the cardines *ca* are of the exocardine type, the character of the stipes *st* and galea *ga* is strikingly similar in both, and even the relative proportions of the segments of the maxillary palpi *mp*, both of which bear a peculiar sense organ *so* on the third segment, are remarkably similar down to the minutest details. Even the tendency for the stipes of both maxillæ to unite with the mentum of the labium to form a synstipites, as in the Dipteron shown in Fig. 71, is paralleled in the Mecoptera; and the comparative morphology of the various structures in the two groups of insects must convince even the most skeptical that the Mecoptera are the nearest living representatives of the types ancestral to the Diptera. I do not feel sure that the Diptera were descended from the Mecoptera themselves, however, since I am more inclined to consider that the Diptera were descended from the Neuropteroid forbears of the common stock which gave rise to the Mecoptera and Trichoptera, and these ancestral types quickly merged with the ancestral Neuroptera and Hymenoptera, so that features present in the Neuroptera and Hymenoptera may also be carried over into the Dipterous line of development. The series represented by Figures 68, 69, 70 and 71 is a very suggestive one, and the relationships indicated by the maxillæ of the insects in question are confirmed by the evidence of many other structures, so that the similarity is hardly due to convergence, but is rather the result of common tendencies inherited from a common ancestry.

In the Dipteron shown in Fig. 80, I have not interpreted the structure labeled *il* as the representative of the lacinia, since the structure in question is imbedded in the basimaxillary membrane in a fashion unknown in any lacinia, and the structure labeled *il* in Fig. 80 is apparently homologous with the interlora *il* of Fig. 55, which is a chitinous bar extending between the maxilla and the region of the hypopharynx. In Fig. 55, however, the maxilla was turned so far over that the structure labeled *il* appears on the other side, although if seen from another angle, it would appear to be on the same side of the maxilla as the structure labeled *il* in Fig. 80; and in the Hymenopteron shown in Fig. 69 the structure *il* is shown much better for comparison with Fig. 80, than is the case with the Hymenopteron shown in Fig. 55. In the Dipteron shown in Fig. 66, the galea *ga* has become enormously elongated, and this tendency for the galea to become very long also occurs in many other Holometabola, such as the Coleopteron shown in Fig. 67, various Lepidoptera, etc. The elongation of the maxilla may be accomplished through the lengthening of the galea, or of the stipes, or of both galea and stipes.

Figure 65 shows the condition typical of the Siphonaptera (fleas) in general, and since all of the parts are preserved in a fairly typical condition, I fail to see how there can be any uncertainty as to the interpretation of the mouthparts of the fleas. The cardo *ca* is of the endocardine type, and hence differs from the Diptera I have seen—and in fact the whole character of the maxilla of the Siphonapteron shown in Fig. 65 is more primitive than most Dipterous maxillæ (and even exhibits a marked resemblance to a Psocid's maxilla) thus indicating that the line of development of the Siphonaptera probably branched off from the ancestral Diptera while the latter had still preserved many Trichopterous and Mecopterous features. The sclerite *pf* of the flea shown in Fig. 65 probably represents the palpifer, and if this is the case, the palpifer is larger and better demarked than in any Diptera, Trichoptera, or Mecoptera I have seen. The lacinia is atrophied (as in Diptera and most Trichoptera) while the galea *ga* is suggestive of that of certain Diptera and Trichoptera. It is rather surprising that the maxillæ of most fleas are not more elongate, since most of the blood-sucking insects allied to the Siphonaptera have long slender maxillæ.

In the Trichoptera, lengthening of the maxilla may be accomplished by the lengthening of the cardo *ca* as in Fig. 62, or more rarely, by the lengthening of the galea *ga* as in Fig. 63, and the latter insect exhibits a tendency toward the lengthening of the galea which takes place to such a remarkable degree in the Lepidoptera. The Trichoptera are usually ectocardine (Figs. 62 and 64, *ca*) as is the case with most Diptera, and Hymenoptera, and in this respect the Trichoptera differ from their near relatives the Lepidoptera, which are mostly endocardine. The cardo *ca* of the Trichopteron shown in Fig. 63 (drawn from specimens given me by Mr. Banks and Dr. Betten) however, is not turned markedly inward or outward, although it might be considered endocardine, if the structure bearing the label *ca* in Fig. 63 is really the cardo. The galea *ga* of the Trichopteron shown in Fig. 62 is suggestive of the Dipterous type; while that of the Trichopteron shown in Fig. 64 is faintly suggestive of certain Hymenoptera. The maxillæ of the Trichoptera which I have studied are not as similar to the maxillæ of the Mecoptera as one might expect, and they are disappointingly unlike the maxillæ of most Neuroptera. They do resemble the maxillæ of the Diptera (with the Siphonaptera) and Hymenoptera, however, and are suggestive of the Lepidoptera in many features. The evidence of the maxillæ of the Trichoptera would therefore indicate rather close affinities with the Lepidoptera, and would point to a common ancestry with the Hymenoptera, Diptera and Siphonaptera, which may be interpreted as meaning that the Trichoptera arose from the Neuroptera-like forbears from which the Hymenoptera were derived, and their line of descent branched off with that of the Mecoptera; while the Diptera, with their derivatives the Siphonaptera, were descended from ancestors which also arose at this point.

The maxilla of a Lepidopteron such as that shown in Fig. 77 is much more primitive than any Trichopteron I have seen, and this indicates that the Lepidoptera may have arisen from ancestors more primitive than either Trichoptera or Mecoptera; and their forbears may have been more like those of the Neuroptera—although the maxilla of the Mecopteron shown in Fig. 53 is almost as primitive as that of the Lepidopteron shown in Fig. 77. The division of the cardo *ca* into basicardo *bc* and disticardo *dc* in the Lepidopteron shown in Fig. 77

denotes a persistence of a primitive Orthopteroid feature which, however, also occurs in the Neuroptera (Figs. 50 and 51) as well, and is retained even in the more highly specialized Neuroptera. The division of the galea *ga* into a basigalea *bg* and a distigalea *dg* is another primitive survival in the insect shown in Fig. 77—and a similar division is also retained in the Neuroptera (Fig. 50) as well. The huge development of the maxillary palpus *mp* in Fig. 77 is a feature which also occurs in the primitive Hymenopteron *Xyela* (not shown in Fig. 58) as well as *Philopotamus* among the Trichoptera, and is a point of similarity between these three groups, although its significance is not very important from the standpoint of phylogeny.

In the Lepidopteron shown in Fig. 78, the maxillary palpus *mp* has grown shorter as the galea *ga* grows longer, and finally in such Lepidoptera as the one shown in Fig. 79, in which the galea *ga* is hugely developed, the maxillary palpus is reduced to the small vestige bearing the label *mp*. In connection with the discussion of the maxillary palpus of the Lepidopteron shown in Fig. 78 (drawn from specimens given me by Dr. Busck), I would call attention to the outgrowth *ppr* of the basal segment of the maxillary palpus, which is unlike anything I have seen in any other insect, although it is a little suggestive of the structure labeled *ga* in Fig. 4, which I have interpreted as the galea in Fig. 4,—but this structure is not on the same side of the sclerite at the base of the maxillary palpi as the structure labeled *ppr* in Fig. 78. The palpi-process *ppr* of the yucca moth shown in Fig. 78 occurs only in the female of this moth and it is indeed astonishing that no other insect should exhibit structures approaching it. Although the use of the organ in question for holding the pollen mass when the female moth pollenizes the yucca flower may account for its persistence and further development when once developed (since the moth has become absolutely dependent upon the yucca plant for its racial existence) we would expect some indications of the formation of a similar structure (though not so well developed) in allied insects, and when the related species have been studied with this in view, we shall doubtless be able to account for the origin of this peculiar structure which is the most remarkable that I have encountered in any insectan maxilla.<sup>1</sup>

<sup>1</sup> Dr. Adam Boving tells me that certain Dascillid beetle larvæ have a structure comparable to this in their maxillæ.

The moth shown in Fig. 78 shows a slight indication of the formation of the paralora *pl* which is well developed in Fig. 79, and may possibly be a structure peculiar to the Lepidoptera, since I have not found it developed in exactly this fashion in the other orders examined. It appears to be developed in connection with the reduction of the labium, and very probably occurs in other insectan orders in which the labium is reduced. The folding of the galea *ga* of the insect shown in Fig. 79, may bear some relation to the peculiar folding of the galea of the Hymenoptera; but I have not yet had the opportunity of investigating this interesting subject further, although I am hoping to do so in the near future.

The maxilla of the aberrant Strepsipteran type shown in Fig. 61 (drawn from a specimen given me by Dr. Brues) is suggestive of the maxillæ of certain Trichoptera, in which the reduced maxillary palpi are about all that is left of the maxillæ. It is quite possible that certain Coleoptera will also exhibit the same phenomenon of the reduction of the maxilla to a palpus borne at the end of a ridge extending across the under side of the head in the region where the atrophied labium was formerly borne; but I have not been able to find such a Coleopteron, and the maxilla of the Strepsiptera would appear to be more like that of certain Trichoptera than any other insects, although I am inclined to regard the Strepsiptera as highly aberrant forms arising from the ancestral Coleoptera near the point of origin of the ancestors of the Hymenoptera and Trichoptera. The Strepsiptera exhibit certain features in common with the Coleoptera, Hymenoptera and Trichoptera, and the above-mentioned origin for the group is the one which best accords with the facts, although I have provisionally placed the Strepsiptera next to the Coleoptera (the usual grouping of these insects). In so placing the Strepsiptera, however, I would not minimize their annectant character between the Coleoptera on the one side, and the Hymenoptera and Trichoptera on the other.

The interrelationships of the orders of living insects indicated by the comparative morphology of various structures such as the wing-veins, mouthparts, terminal abdominal structures, etc., are briefly set forth in the following groupings, in which a few fossil forms are included because of their phylogenetic importance.



## CLASS INSECTA.

## SUBCLASS I. Apterygota.

## Division A. Proturadelpia.

## Superorder 1. Panprotura.

Orders: Protura, Collembola, etc.

## Division B. Thysanuradelpia.

## Superorder 1. Panthysanura.

Orders: Lepismatoida, Machiloida, etc. The Campodeioida (including the Japygids) may be included here or may be placed in a separate superorder.

## SUBCLASS II. Pterygota.

## Division A. Archipteradelpia.

## Superorder 1. Panpalæodictyoptera.

Orders: Palæodictyoptera and a number of fossil forms.

## Superorder 2. Panarchiptera.

Orders: Protephemeroidea, Ephemeroidea (Archiptera), Odonata, etc.

## Division B. Orthopteradelpia.

## Superorder 1. Panisoptera.

Orders: Protoblattoida, Blattoida, Mantoida (possibly a part of the Blattid order), Isoptera, etc.

## Superorder 2. Panorthoptera.

Orders: Protorthoptera, Orthoptera (s. str.), Phasmoida, Dermaptera, etc. The preceding superorder might be included in this superorder also.

## Superorder 3. Panplecoptera.

Orders: Plecoptera, Embiidina, etc.

## Division C. Neuropteradelpia.

## Superorder 1. Panhemiptera.

Orders: Psocoida, Hemiptera (including Homoptera), Thysanoptera, Anoplura, Mallophaga, etc.

## Superorder 2. Panneuroptera.

Orders: Neuroptera, Hymenoptera, Coleoptera, etc. The Strepsiptera may also be included here.

## Superorder 3. Panmecoptera.

Orders: Mecoptera, Diptera, Siphonaptera, Trichoptera, Lepidoptera, etc. This superorder might be included in the preceding one.

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#### ABBREVIATIONS.

<i>a</i> , lacinia dentes, or apical tooth-like processes.	<i>cpr</i> , cardoprocess.
<i>b</i> , midappendix, or modified lacinula.	<i>crp</i> , carpopodite, or fifth segment of crustacean limb.
<i>bc</i> , basicardo, or basal sclerite of cardo.	<i>ct</i> , cardotendons.
<i>be</i> , endite of second segment of crustacean appendage.	<i>lc</i> , disticardo, or distal sclerite of cardo.
<i>bg</i> , basigalea, or basal segment of galea.	<i>dg</i> , distigalea, or distal segment of galea.
<i>bl</i> , basilacinia, or basal sclerite of lacinia.	<i>dig</i> , digitus.
<i>bm</i> , basimaxilla, or basal plate of maxilla.	<i>dl</i> , distilacinia, or distal sclerite ("head") of lacinia.
<i>bp</i> , basipodite, or second segment of crustacean appendage.	<i>dp</i> , dactylopodite, or seventh segment of crustacean limb.
<i>bs</i> , basistipes, or basal sclerite of stipes.	<i>ds</i> , dististipes, or distal sclerite of stipes.
<i>ca</i> , cardo.	<i>en</i> , endopodite, or palpus.
<i>cc</i> , cardocondyle.	<i>eng</i> , endogalea, or inner lobe of galea.
<i>cm</i> , cardomargin.	<i>eus</i> , eustipes.
<i>cp</i> , coxopodite, or first segment of crustacean appendage.	<i>exg</i> , exogalea, or outer lobe of galea.
	<i>f</i> , "fultura."
	<i>ga</i> , galea.

<i>hp</i> , hypopharynx.	<i>mm</i> , micromere, or small palpal segment.
<i>ie</i> , endite of fourth segment of crustacean appendage.	<i>mp</i> , maxillary palpus (endopodite).
<i>il</i> , interlora, or bar connecting maxilla with hypopharynx.	<i>ms</i> , mediostipes, or median area of stipes.
<i>ip</i> , ischiopodite or third segment of crustacean limb.	<i>mx</i> , maxilla.
<i>la</i> , lacinia.	<i>pas</i> , parastipes.
<i>le</i> , lacinulæ (modified spines or setæ).	<i>pf</i> , palpifer.
<i>lf</i> , laciniafer, or lacinia-bearing sclerite.	<i>pl</i> , paralora.
<i>li</i> , labium.	<i>pp</i> , propodite, or sixth segment of crustacean limb.
<i>md</i> , mandible.	<i>ppr</i> , palpiprocess, or process of basal segment of palpus.
<i>me</i> , meropodite, or fourth segment of crustacean limb.	<i>so</i> , sense organ on third segment of maxillary palpus.
	<i>st</i> , stipes.

## EXPLANATION OF PLATES XII-XVII.

All figures are of the insect's right maxilla drawn from the posterior (ventral) surface. The following figures were redrawn from others: Figs. 6, 8, 11, 12, 14, 15, 20, 21, 24, and 25 from Boerner; 7 and 9 from Escherich; 13 from Stummer-Traunfels; 17 from Racovitza; 19 from Imms; 22 from Prell; 29 from Desneux; 66 from Tetley; 76 from Enderlein; 72 from Peterson, and 74 from Snodgrass.

- FIG. 1. Lines of descent of insects and their arthropodan relatives.
- FIG. 2. Maxilla of amphipod crustacean *Gammarus ornatus*.
- FIG. 3. Maxilliped of *Gammarus* sp.
- FIG. 4. Maxilla of larval Neuropteran *Sialis* sp.
- FIG. 5. Maxilla of larval Coleopteron *Passalus* sp.
- FIG. 6. Distilacinia of Sminthurid Collembolan *Sminthurides serroseta*.
- FIG. 7. Lacinia of Lepismatid Apterygotan *Nicoletia neotropicalis*.
- FIG. 8. Distilacinia of Sminthurid Collembolan *Allacma fusca*.
- FIG. 9. Lacinia of Lepismatid Apterygotan *Assmuthia spinossissima*.
- FIG. 10. Maxilla of *Lepisma* sp.
- FIG. 11. Distilacinia of the Podurid Collembolan *Anurida maritima*.
- FIG. 12. Same from another view.
- FIG. 13. Maxilla of Apterygotan *Campodea staphylinus*.
- FIG. 14. Distilacinia of Entomobryid Collembolan *Pogognathus plumbeus*.
- FIG. 15. Distilacinia of Apterygotan *Machilis* sp.
- FIG. 16. Maxilla of Chilopod *Scolopendra* sp.
- FIG. 17. Endite of maxilla of Crustacean *Trichoniscus corsicus*.
- FIG. 18. Maxilla of *Tomocerus flavescens* (Entomobryid Collembolan).
- FIG. 19. Maxilla of Podurid Collembolan *Anurida maritima*.
- FIG. 20. Palpifer, galea, and palpus of maxilla of Podurid Collembolan *Tetrodontophora bielanensis*.

- FIG. 21. Maxilla of same.  
FIG. 22. Maxilla of Proturan *Eosentomon* sp.  
FIG. 23. Maxilla of Apterygotan *Japyx* sp.  
FIG. 24. Distilacinia of Podurid Collembolan *Tetrodontophora bielanensis*.  
FIG. 25. Second endite of maxilla of Crustacean *Gammarus* sp.  
FIG. 26. Maxilla of Apterygotan *Machilis* sp.  
FIG. 27. Leptinid Coleopteron *Leptinus testaceus*.  
FIG. 28. Hemimerid Dermapteron *Hemimerus talpoides*.  
FIG. 29. Leptinid Coleopteron *Platypsyllus castoris*.  
FIG. 30. Immature Odonatan *Æschna umbrosa*.  
FIG. 31. Immature Ephemerid *Oniscigaster* sp.  
FIG. 32. Tettigoniid Orthopteron *Peranabrus scabricollis*.  
FIG. 33. Grylloid Orthopteron *Gryllus* sp.  
FIG. 34. Grylloid Orthopteron *Gryllotalpa* sp.  
FIG. 35. Dermapteron *Anisolabis maritima*.  
FIG. 36. Staphylinid Coleopteron.  
FIG. 37. Cicindelid Coleopteron *Cicindela* sp.  
FIG. 38. Zorotypoid Psocid *Zorotypus snyderi*.  
FIG. 39. Phasmid Orthopteroid *Timema* sp.  
FIG. 40. Embiid *Oligotoma* sp.  
FIG. 41. Grylloblattid Orthopteron *Grylloblatta campodeiformis*.  
FIG. 42. Tridactyloid Orthopteron *Rhipipteryx atra*.  
FIG. 43. *Tettix* sp.  
FIG. 44. Plecopteron *Eusthenia* sp.  
FIG. 45. Isopteron *Termes* sp. from Belgian Congo.  
FIG. 46. Immature Plecopteron *Perla* sp.  
FIG. 47. Blattid *Periplaneta americana*.  
FIG. 48. Mantid *Stagmomantis carolina*.  
FIG. 49. Neuropteron *Corydalus cornutus*.  
FIG. 50. Neuropteron *Ukulodes* sp.  
FIG. 51. Neuropteron *Nemoptera* sp.  
FIG. 52. Mecopteron *Bittacus* sp.  
FIG. 53. Mecopteron *Panorpodes* sp.  
FIG. 54. Hymenopteron *Lyda hypotrophica*.  
FIG. 55. Hymenopteron *Chlorion ichneumonium*.  
FIG. 56. Hymenopteron *Pelecinus* sp.  
FIG. 57. Phasmid *Anisomorpha* sp.  
FIG. 58. Hymenopteron *Xyela* sp.  
FIG. 59. Hymenopteron *Macroxyela* sp.  
FIG. 60. Mecopteron *Panorpa* sp.  
FIG. 61. Strepsipteron *Xenos* sp.  
FIG. 62. Trichopteron *Plectrotargus gravenhorsti*.  
FIG. 63. Trichopteron *Dipseudopsis* (from the Himalayas).  
FIG. 64. Trichopteron, *Neuronia semifasciata*.  
FIG. 65. Siphonapteron *Pulex* sp.

NEUROPTEROIDS

PSYCOIDS

ORTHOPTEROIDS

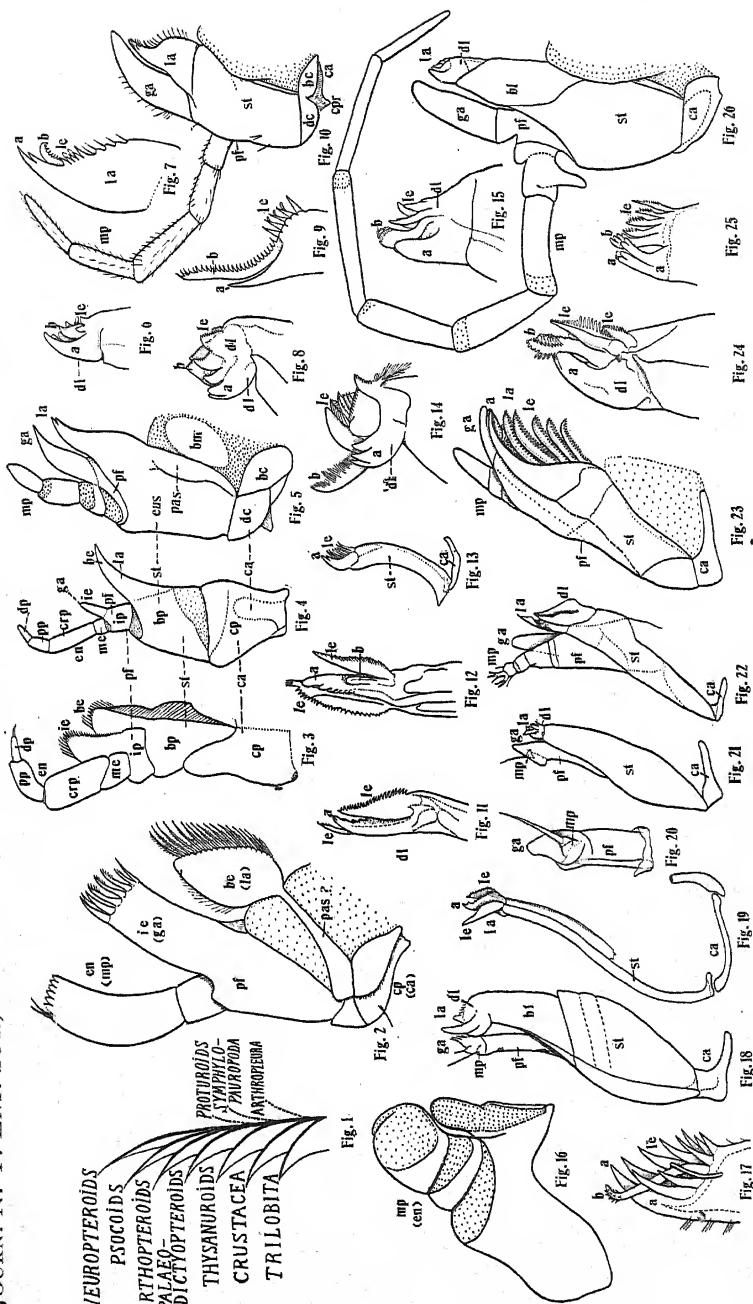
PALAEODICTYOPTEROIDS

THYSANUROIDS

CRUSTACEA

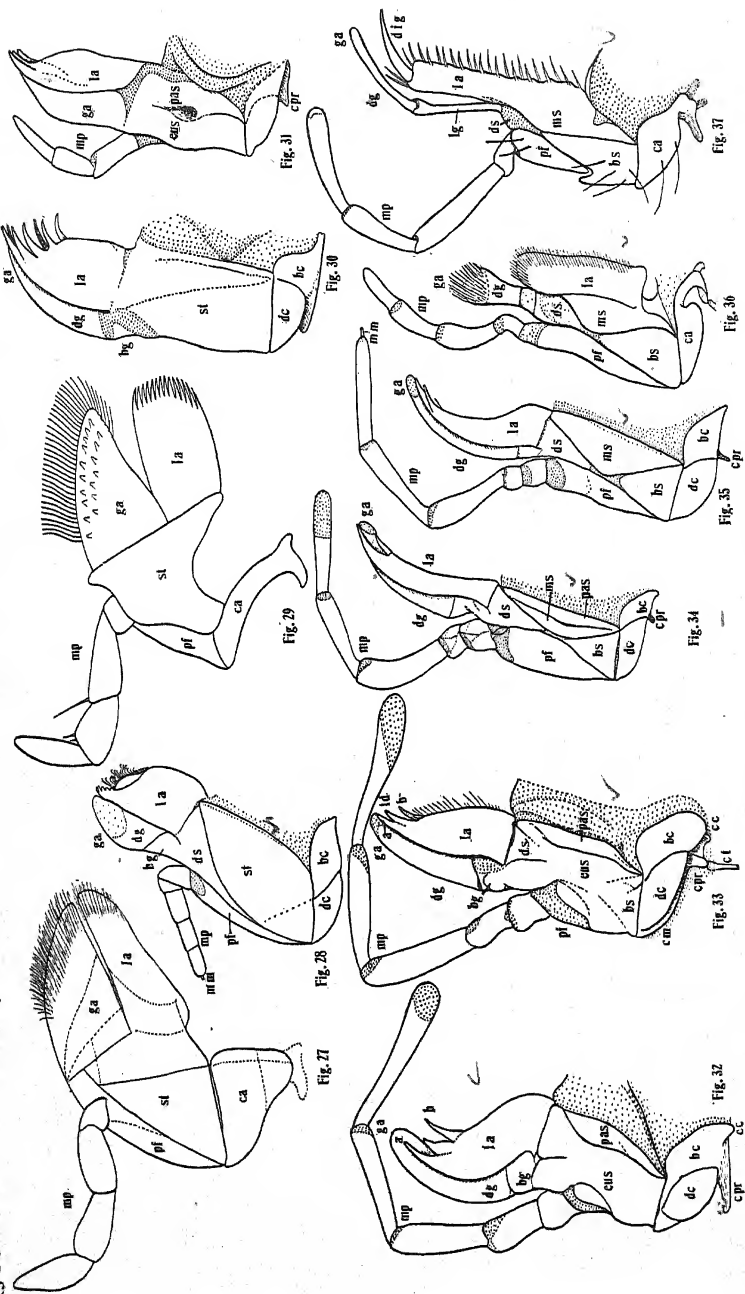
TRILOBITA

PROTHOIDS  
CYAPHLO-  
PHURODA  
ANTHROTERA



MAXILLAE OF INSECTS.

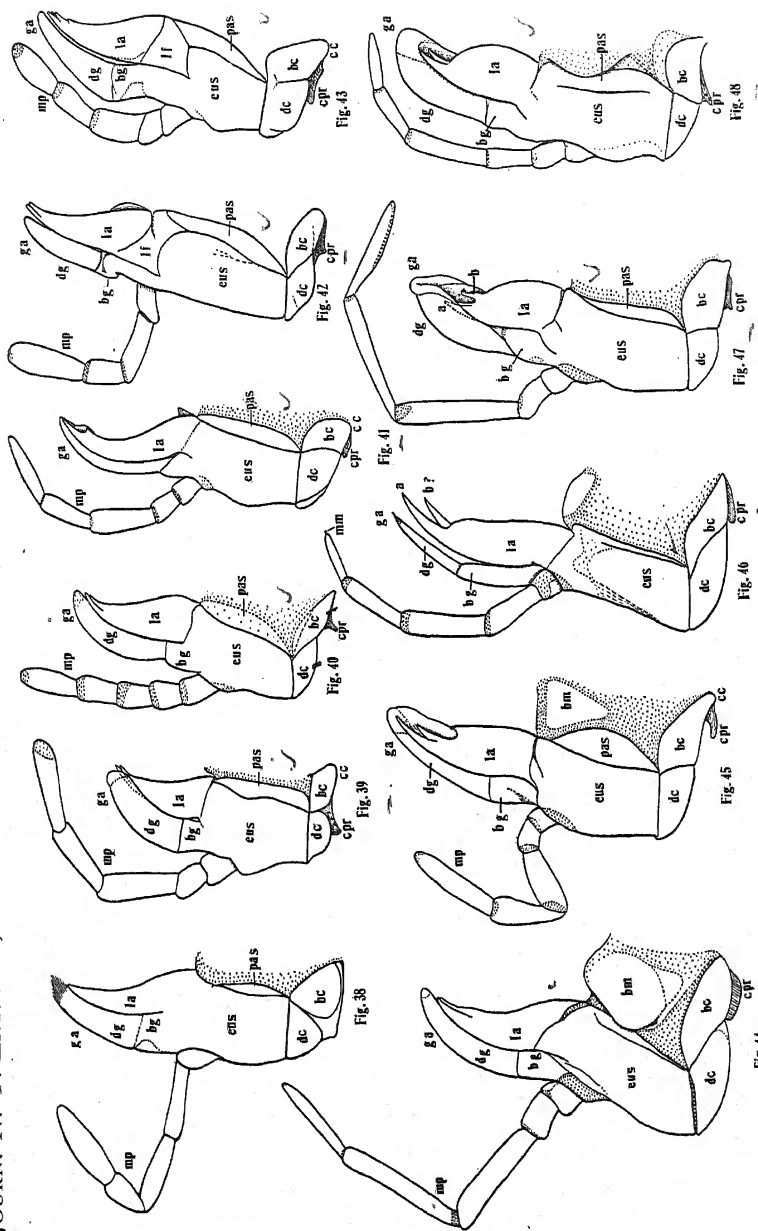




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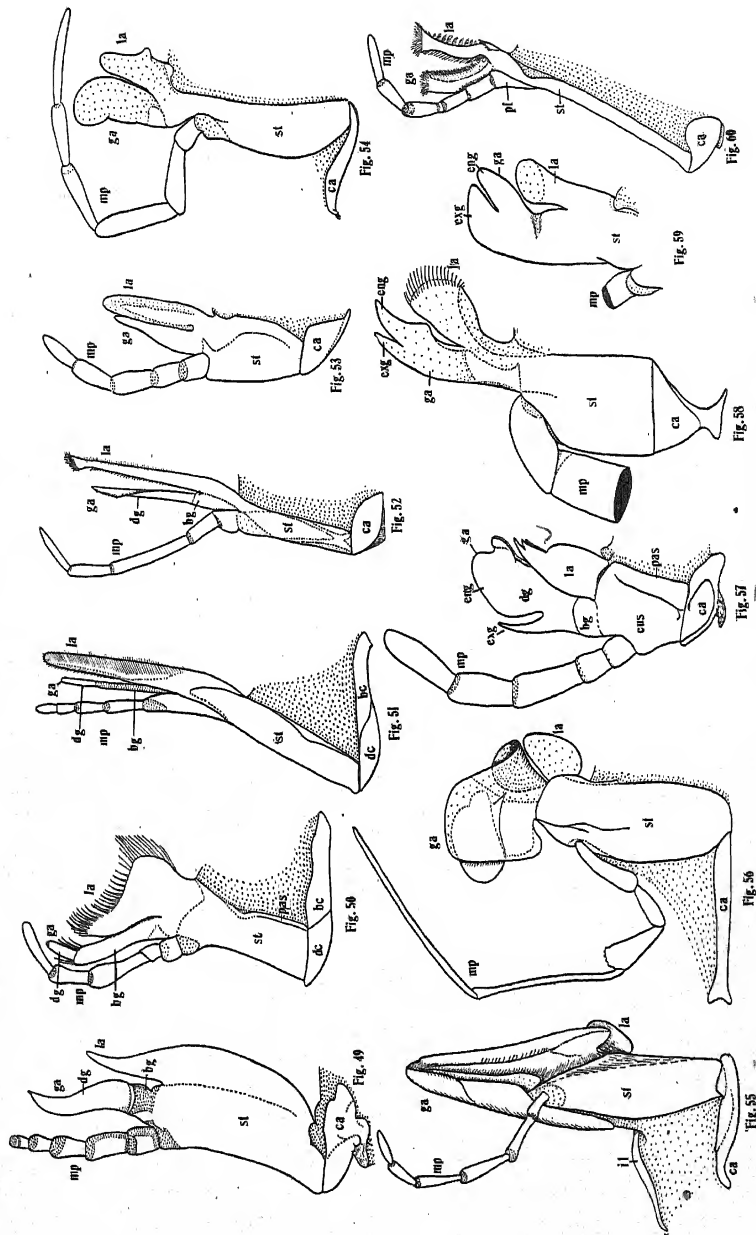






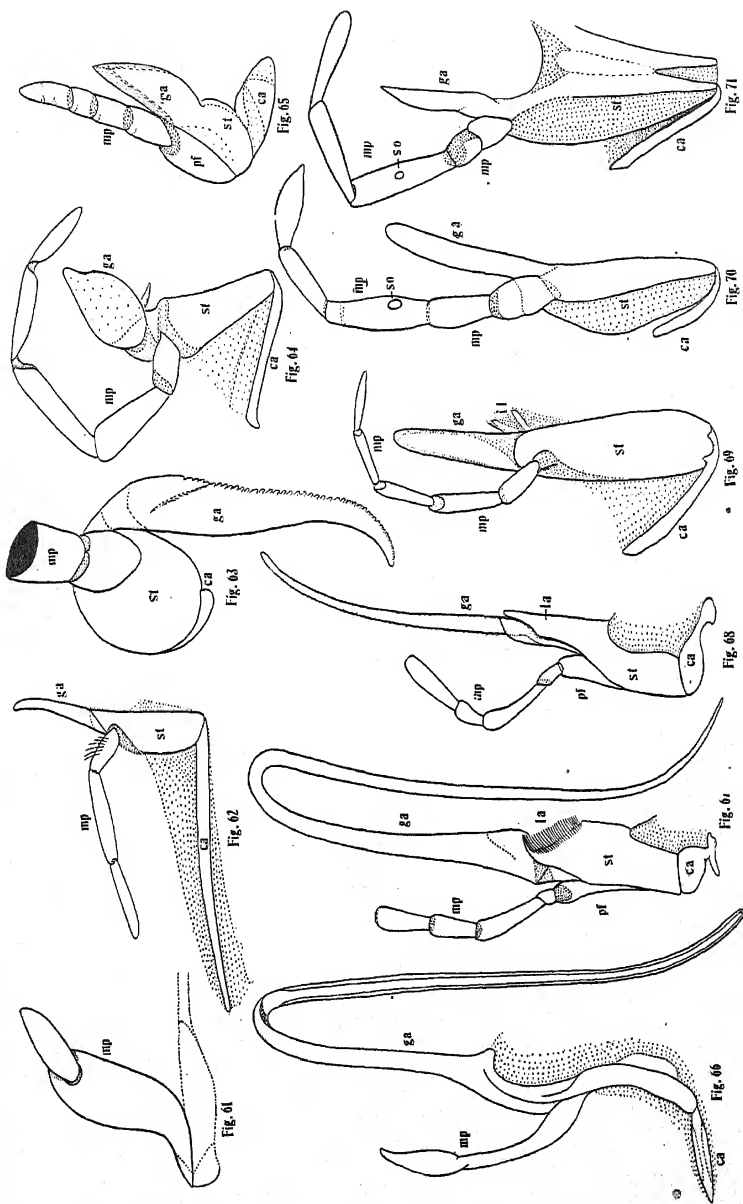
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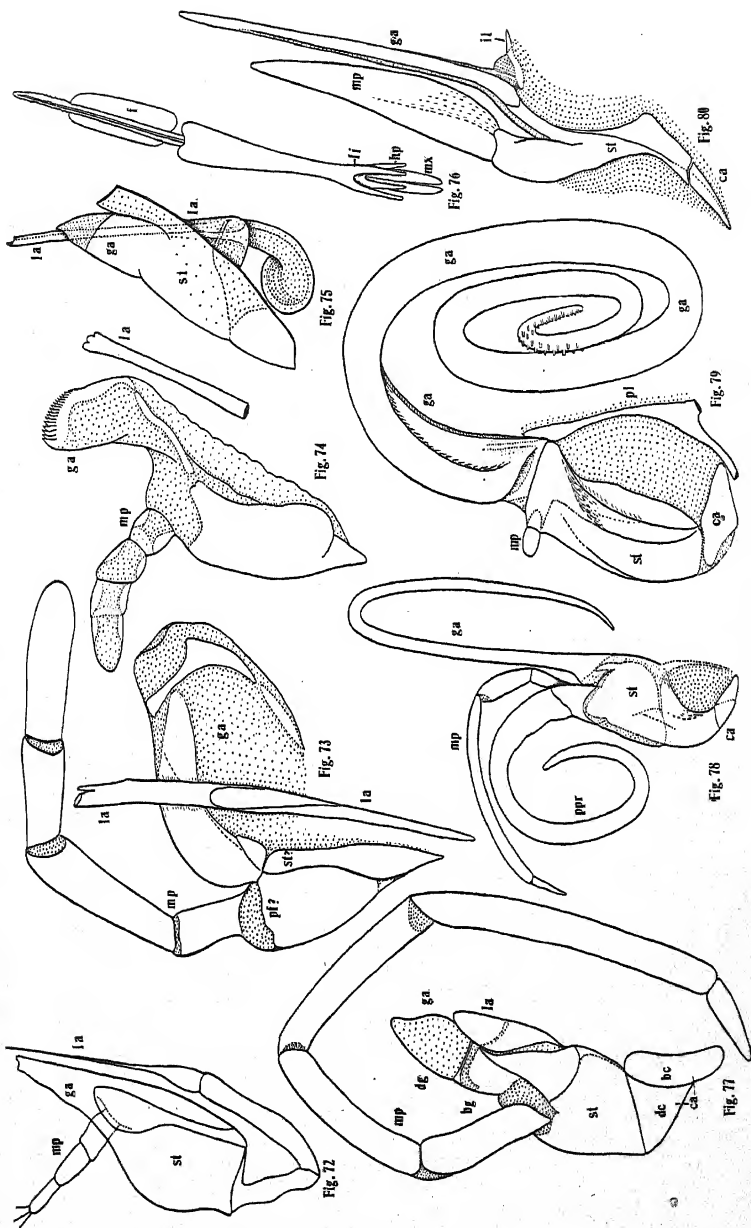
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- FIG. 66. Tabanid Dipteron *Pangonia longirostris*.  
FIG. 67. Meloid Coleopteron *Nemognatha piezata*.  
FIG. 68. Rhipiphorid Coleopteron *Rhipiphorus dimidiatus*.  
FIG. 69. Hymenopteron *Bracon liberator*.  
FIG. 70. Mecopteron *Nannochorista dipteroides*.  
FIG. 71. Dipteron *Asyndulum montanum*.  
FIG. 72. Thysanopteron *Heliothrips*.  
FIG. 73. Psocid *Psocus venustus*.  
FIG. 74. Mallophagan, *Lamobothrium gypsis*.  
FIG. 75. Homopteron *Ptyelus flavescens*.  
FIG. 76. Anopluran *Pediculus vestimenti* (maxilla, hypopharynx, and labium).  
FIG. 77. Lepidopteron *Micropteryx (Eriocephala) sepella*.  
FIG. 78. Lepidopteron *Tegitricula yuccasella*.  
FIG. 79. Lepidopteron *Ctenucha virginica*.  
FIG. 80. Dipteron *Tabanus* sp.
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## QUARTER CENTURY OF SPECIES OF TENTHREDO (HYMENOPTERA).<sup>1</sup>

BY ALEX. D. MACGILLIVRAY,

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With many species of Hymenoptera where the color forms an important part in distinguishing the species, the males are frequently differently colored from the females. Unless specimens are taken in copulation or the environmental conditions are such that the two sexes can be identified without question, it necessitates the describing of the males and females under different names. Norton and others have tried to combine the two sexes from general appearances, but I believe it is much better to make a synonym than to make the mistake of combining males and females although quite similar in general appearance, that do not belong together. Because of this inability to recognize the two sexes of the same species, the species of *Tenthredo* must be treated in this way.

*Tenthredo remea* new species.

Female. Body black with the labrum, clypeus, mandibles, a spot on each occipital orbit, a dot at the meso-caudal angles of the compound eyes, collar

<sup>1</sup> Contributions from the Entomological Laboratories of the University of Illinois, No. 77.

broadly, tegulae, spot above posterior coxae, most of basal plates, ends of coxae, trochanters, femora except a bar on upper side of distal end, tibiae, and tarsi, yellow; clypeus roundly emarginate; antennae with the first segment of the flagellum longer than the second and third together, the second longer than the third; frontal furrow broad, deep, with a median carina, extending to the median ocellus; head polished; mesonotum and mesoscutellum finely punctured; abdomen depressed; saw-guides short, upper margin oblique, ventral margin rounded, distal end obliquely broadly rounded; wings yellowish hyaline, veins brown, stigma and costa paler. Length, 14 mm.

*Habitat:* Corvallis, Oregon; received from A. L. Lovett, Finch collector.

This is a beautiful large species, the *subcærulea* of MacGillivray.

***Tenthredo remora* new species.**

Male. Body black with the labrum, clypeus, mandibles, genal orbits, extending broadly onto the occipital orbits, a dot at meso-caudal angle of each compound eye, the collar, the tegulae, the mesopleura, pectus, the metapleura entirely, the basal plates, and the legs except a dot or bar on the distal part of the upper side, dirty white; abdomen rufous, approximating remainder of body in shade on ventral aspect; clypeus squarely emarginate; antennae with the first segment of the flagellum longer than the second, shorter than the second and third together, the second longer than the third; wings hyaline, veins and stigma pale. Length, 12 mm.

*Habitat:* Corvallis, Oregon; F. C. Sheford, collector.

This species appears something like *magната*.

***Tenthredo reduvia* new species.**

Female. Body black with the labrum, clypeus, mandibles, genal orbits, extending broadly onto the occipital orbits, continued as a line along the frontal orbits, dilated and extending beyond the meso-caudal angles of the compound eyes, collar broadly, tegulae, a spot on the mesal margin of each lateral lobe of the mesonotum, the mesoscutellum, a broad oblique band on the metapleura, a spot above the posterior coxae, the sides of the basal plates, the coxae and trochanters, becoming rufous on the posterior, and the lateral margins of the first three abdominal segments, yellowish-white; the legs rufous except the parts named and an indefinite band on the proximal part of the profemora and protibiae and also beyond above the third segment of the flagellum, indistinctly rufous; antennae with the first segment of the flagellum long, not as long as the subequal second and third segments together; clypeus narrowly emarginate; frontal furrow broad with a mesal carina; head polished; saw-guides with the dorsal and ventral margins converging, the distal portion obliquely rounded; wings hyaline, veins brown, costa and stigma pale. Length, 10 mm.

*Habitat:* Corvallis, Oregon; received from A. L. Lovett, Foster collector.

This species is near *scævola* Cresson.

***Tenthredo retosta* new species.**

Male. Body black with the labrum, clypeus, mandibles, genal orbits, occipital orbits, frontal orbits for one-half their length, connected ventrad of the antennæ, a dot at the meso-caudal angle of each compound eye, collar, sides of pronotum, tegulæ, mesopleura, pectus, metapleura, spot above posterior coxæ, sides of basal plates, legs except a black line on the protibiæ, protarsi, mesotibiæ, mesotarsi, and upper side of metacoxæ, metatrochanters, metatibiæ, and all of the metatarsi, yellow-white; venter of the abdomen, yellow-white, extending along each side as a narrow margin onto the dorsal aspect; antennæ with second and third segments of flagellum subequal, together longer than the first; clypeus roundly truncate; frontal furrow broad and shallow; wings hyaline, veins and stigma brownish. Length, 8 mm.

*Habitat*: ?Corvallis, Oregon; received from A. L. Lovett.

***Tenthredo resima* new species.**

Female. Body black with the labrum, clypeus, mandibles, genal orbits, extending broadly onto the occipital orbits and as a line along the frontal orbits, dilated at the meso-caudal angles of the compound eyes, connected by a transverse spot below the antennæ, the collar, the tegulæ, the mesoscutellum, a broad band on the mesopleura, spot on the metapleura, a spot above the metacoxæ, the sides of the basal plates, the coxæ and trochanters almost completely, and the sides of abdominal segments one to three, yellow; the legs, except an indefinite band on the upper side of the proximal parts of the profemora, and the abdomen beyond the third segment, rufous; clypeus squarely emarginate; frontal furrow deep, V-shaped, without mesal carina; antennæ with second and third segments of the flagellum elongate, subequal, together longer than the first segment; saw-guides with the dorsal margin straight, ventral margin straight on cephalic portion, caudal rounding and oblique; wings hyaline, veins brown, costa and stigma pale. Length, 10 mm.

*Habitat*: Mary's River, Corvallis, Oregon; received from A. L. Lovett.

***Tenthredo ripula* new species.**

Male. Body black with the labrum, clypeus, mandibles, genal orbits, occipital orbits broadly, extending onto vertical orbits, connecting by a narrow line from genal orbits to frontal orbits, area between and above antennæ, extending as two lines along the sides of the frontal furrow, caudal margin of the head, prothorax, triangular spot on each half of the median lobe of the mesonotum, mesoscutellum, metascutellum, lateral and ventral aspects of the thorax, ventral aspect of abdomen, extending on each side as a margin on dorsal aspect, legs, except a black line on femora, tibiæ, and tarsi, yellowish-white; clypeus roundly emarginate; frontal furrow deep, concave; wings hyaline, veins black, costa and stigma white. Length, 9 mm.

*Habitat*: Corvallis, Oregon; received from A. L. Lovett.

***Tenthredo rima* new species.**

Male. Body black with the labrum, clypeus, mandibles, the genal orbits, extending broadly onto the occipital orbits, narrowly onto the frontal orbits, a long spot at the meso-caudal angle of each compound eye, the collar, tegulae, the ventral margin of the pronotum, band on the mesopleura, pectus, band on metapleura, spot above posterior coxae, sides of basal plates, venter of abdomen, extending as a narrow margin onto the dorsal aspect, and legs except a black band above, broader on coxae, yellow-white; clypeus roundly emarginate; antennae with the first segment of the flagellum subequal to the subequal second and third segments together; frontal furrow broad and shallow; wings hyaline, veins brownish, costa and stigma pale. Length, 10 mm.

*Habitat*: Corvallis, Oregon; received from A. L. Lovett, Scott, collector.

***Tenthredo rabida* new species.**

Female. Body black with the labrum, clypeus, mandibles, collar, tegulae, spot above posterior coxae, sides of basal plates, and the underside of the front and middle tibiae, greenish-white; abdomen beyond the third segment, including the saw-guides, except their margins, rufous, also the distal segment of all the tarsi; clypeus broadly roundly emarginate; antennae with the first segment of the flagellum longer than the second but distinctly shorter than the subequal second and third segments together; head polished, frontal furrow deep, irregular; saw-guides with the dorsal margin straight, the ventral margin straight, becoming convex and convexly rounded at apex; wings smoky, the veins including the costa, black, the stigma paler. Length, 12 mm.

*Habitat*: Mary's Peak, Corvallis, Oregon; L. G. Geniner, collector.

This species runs in tables to *semirufa* Norton.

***Tenthredo restricta* new species.**

Male. Body black with the labrum, clypeus, mandibles, area between the antennae, dot above each antenna, genal orbits, lower half of occipital orbits, dot at summit of eyes, collar, tegulae, prothorax for most part, mesoscutellum, mesopleura and metapleura for most part, mesosternum, spot above posterior coxae, sides of basal plates, a mesal dot on the tergum of the first abdominal segment, a broad band upon the caudal part of the second to fourth abdominal terga, greater part of venter of abdomen, prothoracic and mesothoracic legs, except a black line on femora and tibiae, tarsi black, metathoracic legs with the coxae, and underside of the trochanters and femora, yellow; abdomen with fifth and following segments rufous; antennae with third segment longer than fourth, fourth and fifth subequal; clypeus deeply emarginate; frontal furrow with sides converging below; wings hyaline, veins and stigma and costa black. Length, 11 mm.

*Habitat*: Alsea, Oregon; A. L. Lovett, collector.

This species runs to *nigritibialis* from which it is easily separated.

**Tenthredo ralla** new species.

Female. Body black with the labrum, clypeus, mandibles, genal orbits, extending onto the frontal orbits and broadly onto the occipital orbits, the collar, the tegulae, the ventral margin of the pronotum, the mesopleura broadly, the metapleura, a spot above the posterior coxae, the sides of the basal plates, the coxae, the trochanters, and the proximal portion of the femora, yellowish-white; the pectus for the most part, extending onto the pleural pale marks, the remainder of the legs, and the abdomen beyond the middle of the first segment, rufous; clypeus narrowly shallowly emarginate; frontal furrow shallow, irregular, not extending to the median ocellus; saw-guides with the dorsal margin straight, the ventral slightly convex, the distal end rounded and truncate; the wings yellowish, the veins including the costa, yellowish, stigma blackish. Length, 12 mm.

*Habitat*: Mary's Peak, Corvallis, Oregon; A. L. Lovett, collector.

This species has many characteristics in common with *signata* Norton.

**Tenthredo repleta** new species.

Female. Body black with the four or five distal segments of the antennae, the underside of mesotibiae and metatibiae, and all the tarsi for the most part, dirty white; antennae with the first segment of the flagellum a little longer than the second, the second and third subequal; clypeus roundly emarginate; the mesopleura and notum punctured; the saw-guides with the dorsal and ventral margins slightly converging, the distal end roundly truncate; the wings smoky, the veins including the costa and stigma, black. Length, 13 mm.

Male. The two sexes are indistinguishable except that the male is more slender and shorter. Length, 11 mm.

*Habitat*: Mary's Peak, Corvallis, Oregon; A. L. Lovett and L. G. Gontner, collectors.

This species appears to be near *nigricollis* Kirby.

**Tenthredo reflua** new species.

Male. Body black with clypeus, labrum, mandibles, spot beneath antennae, genal orbits, lower half of occipital orbits, collar, tegulae in part, pronotum in great part, oblique band on mesopleura, mesosternum broadly, separated from mesopleura by a narrow black band, line on metapleura, spot above posterior coxae, sides of basal plates, some of the cephalic sterna, prothoracic coxae, remainder of prothoracic legs beneath, mesothoracic legs beneath except their tarsi which are black, and the coxae and trochanters and a small proximal portion of the metathoracic femora, yellow; distal part of the metafemora, their tibiae, and tarsi beneath, and the abdomen beyond the third segment, rufous; the second and third abdominal terga each with a mesal rufous spot; antennae with third segment longer than fourth, fourth and fifth subequal; frontal fur-

row narrow and deep; wings hyaline, slightly smoky, veins and stigma and costa and stigma blackish. Length, 12 mm.

*Habitat*: Bellfountain, Oregon; A. L. Lovett, collector.

This species is similar to *variegata* but larger and stouter.

***Tenthredo rabiosa* new species.**

Female. Body black with the labrum, clypeus, front, mandibles, genæ, orbits, lower half of occipital orbits, facial orbits broadly, dilated above, a dot above each antenna, pronotum, tegulæ, a triangular mark on each lateral lobe of mesonotum, the two subadjacent, mesoscutellum, a broad band on each mesopleuron, a line on each metapleuron, a spot above the metacoxæ, the sides of the basal plates, a band on the lateral margin of abdominal segments one to three, the coxæ and trochanters, except partially above, yellow; abdomen beyond the third segment, legs beyond trochanters, and antennæ beyond third segment, rufous; clypeus deeply emarginate; antennæ with third segment nearly as long as the fourth and fifth together, the fourth longer than the fifth; frontal furrow deep, narrow; head polished, mesonotum finely punctured; saw-guides with dorsal and ventral margins straight, distal end bluntly rounded; wings yellowish hyaline, veins black, costa and stigma yellow. Length, 12 mm.

*Habitat*: Philomath, Oregon; A. L. Lovett, collector.

This species is similar in general appearance to *scavola* Cresson.

***Tenthredo rabula* new species.**

Male. Black with the clypeus, labrum, mandibles, spot below antennæ, dot above each antenna, dot at summit of each compound eye, genal orbits, ventral half of occipital orbits, collar, tegulæ, irregular band on mesopleuræ, line on metapleura, spot above posterior coxæ, all the legs except a black line above, the sides of the basal plates, venter of the abdomen, extending as triangular spots onto terga and two sides connected by a fine line along caudal margin, white; antennæ with first segment of flagellum longer than second, second and third subequal; wings hyaline, slightly smoky, veins blackish, stigma in great part pale, costa with proximal half pale and distal half black. Length, 9 mm.

*Habitat*: Corvallis, Oregon; Hunter, collector.

This species runs to *pectoralis*. Its markings are very distinctive for a male.

***Tenthredo racilia* new species.**

Male. Body black with the labrum yellow and the legs beyond the trochanters and abdominal segments one to six, rufous; antennæ pale beneath; antenna with first segment of flagellum longer than the second, the second and third subequal; clypeus broadly roundly emarginate; head polished; frontal furrow constricted below, walls not high; wings hyaline, costa and most of

the stigma pale, the medial and radial veins black, the others pale. Length, 10 mm.

*Habitat:* Corvallis, Oregon; L. B. Couch, collector.

This species runs to *rubens*.

***Tenthredo refractaria* new species.**

Female. Body black with labrum, two spots on the clypeus, spot on each mandible, spot on each genal orbit, an interrupted line on facial orbits, collar broadly, tegulæ, oval spot on pleura, spot above posterior coxæ, all the coxæ except above, and the trochanters, yellow; the legs beyond the trochanters, except a black ring on distal end of posterior tibiæ, and the abdomen beyond the basal plates, rufous; antennæ rufous beneath, first segment of flagellum longer than second, second longer than third; clypeus roundly shallowly emarginate; saw-guides with the dorsal and ventral margins converging, bluntly pointed at apex; wings hyaline, smoky to yellowish, costa and most of stigma pale, veins black. Length, 12 mm.

*Habitat:* Union County, Oregon; A. L. Lovett, collector.

This species resembles *edwardsii*.

***Tenthredo resupina* new species.**

Male. Body black with clypeus, labrum, mandibles, genal orbits, ventral half of occipital orbits, dot at summit of compound eyes, collar, tegulæ, ventral margin of pronotum, band on mesopleura, all the coxæ, and trochanters, femora of the prothoracic and mesothoracic legs, except a black line above, yellow; remainder of legs and the abdomen beyond the basal plates, rufous; antennæ with the first segment of the flagellum slightly longer than the second, the second and third subequal; antennal furrow deep and broad, not constricted below; clypeus deeply emarginate; head polished; thorax sparsely punctate; wings hyaline, yellowish, costa and stigma pale, veins black. Length, 8 mm.

*Habitat:* Belfountain, Oregon; A. L. Lovett, collector.

This species runs in tables to *scavola* Cress.

***Tenthredo rustica* new species.**

Male. Body black with the clypeus, labrum, mandibles, spot between antennæ, dot above each antenna, dot at corner of each compound eye, line on ventral part of facial orbits, genal orbits, ventral half of occipital orbits, line on collar, tegulæ, ventral margin of pronotum, mesosternum, continuous with mesopleura, line on metapleura, spot above posterior coxæ, lateral margins of basal plates, prothoracic legs except black line above, extending to end of tibiæ, tarsi more or less rufous, coxæ and trochanters and femora of mesothoracic legs, except black line above, and coxæ and trochanters of metathoracic legs, except black line above, yellow; mesotibiæ, metafemora in great



part, metatibiæ, and abdomen beyond basal plates, rufous; antennæ with the first segment of the flagellum slightly longer than the second, second and third subequal; wings hyaline, costa and proximal portion of stigma pale, veins black. Length, 10 mm.

*Habitat*: Union County, Oregon; A. L. Lovett, collector.

This species is quite similar to *variegata*.

***Tenthredo reticentia* new species.**

Female. Body black with the labrum, clypeus, mandibles, spot on lower portion of occipital orbits, dot at angle of compound eyes, collar, tegulæ, spot above posterior coxæ, sides of basal plates, and the underside of the prothoracic femora more or less, yellow; all the femora, prothoracic and mesothoracic tibiæ, except above, the metathoracic tibiæ entirely and all the tarsi more or less, rufous; antennæ with the first segment of the flagellum nearly as long as the subequal second and third segments together; frontal furrow deep, parallel sides; wings hyaline, veins, costa, and stigma for the most part, black. Length, 10 mm.

*Habitat*: Corvallis, Oregon, E. O. Dalgren, collector and Alsea, Oregon, A. L. Lovett, collector.

This species runs to *nigrifascia*.

***Tenthredo reputina* new species.**

Male. Body black with the clypeus, labrum, mandibles, genal orbits, ventral part of facial orbits, connected ventrad of antennæ, dot above each antenna, dot at summit of compound eyes, most of occipital orbits, collar, tegulæ, lateral portion of pronotum in great part, mesoscutellum, mesosternum, extending broadly onto mesopleura, line on metapleura, spot above posterior coxæ, sides of basal plates, and all the legs except a black line above, metatibiæ and metatarsi in part rufous, yellow; abdominal terga, except a narrow cephalic portion, often interrupted at middle of cephalic margin, rufous; abdominal sterna yellow and rufous; antennæ with first segment of the flagellum longer than the second, second longer than third; wings hyaline, veins and stigma and costa black. Length, 9 mm.

*Habitat*: Bellfountain, Oregon; A. L. Lovett, collector.

This may prove to be the male of *magnifica*, although it is differently colored.

***Tenthredo remissa* new species.**

Male. Body black with the clypeus, labrum, mandibles, genal orbits, extending slightly onto occipital orbits, dot above each antenna, dot at angles of compound eyes, collar, tegulæ, margins of pronotum, irregular line on mesopleura, pectus, line on metapleura, spot above posterior coxæ, sides of basal plates, coxæ and trochanters and femora of all legs beneath, yellow; tibiæ of

metathoracic legs rufous beneath, their tarsi black, and abdomen beyond middle of second segment, rufous; antennæ with first segment of flagellum longer than second, second and third subequal; frontal furrow shallow; wings hyaline, stigma rufous, costa and veins black. Length, 9 mm.

*Habitat*: Corvallis, Oregon; received from A. L. Lovett.

This species is near *reposita* from which it can be distinguished by the color of the pleura.

***Tenthredo replata* new species.**

Female. Body black with the clypeus, labrum, mandibles, genal orbits, extending slightly onto facial and occipital orbits, collar, tegulæ, spot on margins of pronotum, band on mesopleura, line on metapleura, spot above posterior coxæ, sides of basal plates, and all the legs beneath, yellow; abdomen beyond the third segment, rufous; antennæ with the first segment of the flagellum longer than the second, second and third subequal; frontal furrow broad, flat; saw-guides straight above, convex below converging gradually to a blunt point above; wings smoky, stigma rufous, veins and costa black. Length, 10 mm.

*Habitat*: Ormsby County, Nevada; C. F. Baker, collector.

This species is evidently related to *zetes* Kirby.

***Tenthredo resegmina* new species.**

Male. Body black with the clypeus, labrum, mandibles, genal orbits, ventral half of occipital orbits, dot at summit of compound eyes, collar, tegulæ, ventral margin of pronotum, band on mesopleura, small line on metapleura, spot above posterior coxæ, pectus, sides of basal plates, coxæ, trochanters, prothoracic and mesothoracic femora, except above, prothoracic tibiæ, except a line above, their tarsi and mesothoracic tibiæ and tarsi suffused with rufous, yellow; metathoracic femora except above, their tibiæ and tarsi, and the abdomen beyond the basal plates, rufous; antennæ with the first segment of the flagellum longer than the second, the second and third subequal; frontal furrow concave; wings yellowish hyaline, stigma and costa rufous, veins black. Length, 9 mm.

*Habitat*: Bellfountain, Oregon; A. L. Lovett, collector.

This species is very similar to *messica*.

***Tenthredo reperta* new species.**

Female. Body black with the clypeus, labrum, dot at summit of eyes, inconspicuous, round spot on ventral half of occipital orbits, collar, tegulæ, spot above posterior coxæ, all of front and middle legs beneath, hind tibiæ and tarsi beneath, yellow; antennæ with first segment of flagellum longer than second, second slightly longer than third; saw-guides broad, short, dorsal margin straight, ventral margin and apex broadly convexly rounded, bluntly

pointed; wings hyaline, slightly smoky, stigma rufous, costa and veins black. Length, 10 mm.

*Habitat*: Julietta and Lewiston, Idaho; J. M. Aldrich, collector.

This species is similar to *alpha* but smaller.

*Tenthredo reposita* new species.

Male. Body black with the clypeus, labrum, mandibles, ventral portion of facial orbits, connected between antennæ, dot above antennæ, dot at angles of compound eyes, genal orbits, most of occipital orbits, collar, tegulae, lateral margin of pronotum broadly, pectus, continuous with and covering most of mesopleura, line on metapleura, spot above posterior coxæ, sides of basal plates, front and middle legs, except a black line above, coxæ and trochanters and femora of metathoracic legs, except above, yellow; metathoracic tibiæ and tarsi except above, and abdomen beyond middle of first segment, rufous; antennæ with first segment of flagellum longer than second, second and third subequal; frontal furrow deep; wings hyaline, costa in great part rufous, stigma and veins black. Length, 9 mm.

*Habitat*: Bellfountain, Oregon; A. L. Lovett, collector.

This species is near *reflua*, from which it can be separated by the coloration of the pleura.

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## PROCEEDINGS OF THE NEW YORK ENTOMOLOGICAL SOCIETY.

### MEETING OF NOVEMBER 7.

A regular meeting of the New York Entomological Society was held at 8 P.M., on November 7, 1922, in the American Museum of Natural History, Vice-President Harry B. Weiss in the chair, with 12 members present.

On motion by Mr. Woodruff, the Publication Committee was requested to print in each number of the JOURNAL the actual date of issue of the preceding number.

Mr. Davis exhibited 99 species of "Orthoptera of Staten Island" and speaking extemporaneously exhibited a remarkably intimate acquaintance with the taxonomy and life habits of each species. One by one he took up the earwigs, dwelling upon the families of young he had seen, the roaches with descriptions of their nuptial greetings, the sexual differences in the native species, and the conditions under which the introduced species occurred, and the mantids with an account of the successful establishment, through egg masses he had personally distributed, of the Chinese species. Then he spoke of the Walking Stick insects and the curious lack of males of one species and passed next to Katydid and crickets that make the summer and autumn nights songful. The decreasing number of true Katydid and the number of pink

Katyids on Staten Island were noticed, as well as the character of the song. In connection with these stridulating Orthoptera Mr. Davis mentioned Hancock's breeding experiments, Miss Campbell's discovery of the true Katydid colony near Moravian Cemetery on Staten Island, and the great number formerly occurring near the late Louis P. Gratacap's home. The longhorned grasshoppers were next considered, with an explanation of the diminution of the song towards the end of the year; then the crickets with an account of the European species on Staten Island, the song in May of *assimilis* and its long- and short-winged forms.

Mr. Davis pointed out that he was following the succession of families adopted in Morse's New England Orthoptera, which he preferred, though from the much greater number of species treated, Blatchley's Orthoptera of N. E. America was more useful. This led him to speak of taxonomic difficulties which abounded in the short-horned grasshoppers and pygmy grasshoppers that closed his list. Among these he showed a female found 500 feet above the street level in the Woolworth Building, and brought a feminine reporter to his house to inquire into its supposed connection with the Rocky Mountain locust now extinct. All through he was closely followed by the members present who joined in a general discussion at the close of his remarks.

Mr. Leng read for Charles Louis Pollard an account of the "Oviposition of *Monohammus*" recording his observations at Rangeley, Maine, on August 22d. The female gnaws with her mandibles a hole in the bark about the size of a pinhead and no deeper, then presses the short ovipositor into the hole with some force. One egg only is laid in each hole, the operation being complete in about three minutes. Mr. Pollard's observations showed the beetles to be both polygamous and polyandrous.

Mr. Nicolay exhibited *Enoclerus liljebladi* recently described by Wolcott, a northern species heretofore confused with the more southern *E. ichneumonius*, and stated that he had found it at Bellport, L. I., in July. He also exhibited *Blethisa multipunctata* from Edmonton, Canada.

Mr. Dickerson called attention to a quotation from the British Medical Journal in "Science," referring to a new remedy for trypanosome diseases, especially sleeping sickness. Dr. Bequaert said some such remedies, from lack of chemical permanence, had proved dangerous; and doubtless further careful trial would precede premature announcement of success.

#### MEETING OF NOVEMBER 21.

A regular meeting of the New York Entomological Society was held at 8 P.M., on November 21, 1922, in the American Museum of Natural History, Vice-President Harry B. Weiss in the chair, with 13 members present.

Mr. Nicolay under the title "Beetling in the Great Smoky Range of Tennessee" gave an interesting account of his visit with Mr. Frank Mason, of Philadelphia, to Sweetwater, Tenn., on October 2, and of the week following spent in the vicinity, principally in the Mountains of Monroe County, where

the Tellico River Lumber Co.'s operations made food and lodging possible. Traps were set at Tellico Plains, 3,500 feet elevation, and visits made to the surrounding peaks, running up to 6,200 feet, which were reached by logging train. *Cicindela patruela* and *rufiventris*, *Scaphinotus andrewsi* and *enicollis*, *Spheroderus canadensis* and *bicarinatus* var. and *Nomarectus hubbardi* were found but not in large quantities. The physical discomfort of the trip was considerable and "nothing but wet feet and water down the back" was sometimes the result.

Mr. Notman spoke of "Some Interesting Captures of 1922" resulting from his continued beetle survey of New York State; six weeks in May and June were spent in visiting Nichols, near Owego, Canisteo, Red House, seven miles from Salamanca, Oakfield and Oak Orchard Swamp, near Batavia, and Springwater near Rochester. 6,000 specimens were taken, mounted and studied, adding much to the known distribution within the State.

Mr. Lesieski exhibited a *Cicindela generosa* found July 22d at Oradell which was as coppery red as *formosa*.

Mr. Weiss exhibited Bull. 367 New Jersey Agricultural Experiment Station on "Chemotropism of Mosquitoes" by Willem Rudolfs, in which it was shown that carbon dioxide and ammonia were attractive to them.

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A REVISION OF THE TRYPETIDÆ OF  
NORTHEASTERN AMERICA.

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This work was undertaken to provide keys for the identification of the species of Trypetidæ occurring in northeastern America. This region extends north to the Laurentian Mts., west to include Minnesota and south to embrace Kentucky and Virginia. The generic limits in this family are not well marked, and since no recent general keys are available, for our fauna, this revision may prove useful to entomologists.

For a clear discussion of the family characteristics, as well as for an explanation of technical terms, I refer the reader to Bezzi's recent paper on Indian Trypaneids (1914). Besides the new family name of Trypaneidæ proposed by Bezzi, both Euribiidæ and Tephritidæ have been suggested and used for this group. I prefer however, for the present, to use the old and familiar name of Trypetidæ.

The material used in this family has been largely that of the collection of Cornell University, and I take this occasion to thank the members of the department of Entomology for courtesies extended. I have also been greatly helped by loans of material and suggestions from several entomologists and welcome this opportunity, therefore, to thank J. M. Aldrich, E. T. Cresson, C. W. Johnson, S. J. Hunter, H. H. Severin, A. L. Melander, and R. C. Shannon.

In 1873 in the third volume of his Monograph, Loew included a key for the genera of North America. Later, Williston published one in his Manual of North American Diptera and still later Coquillett re-

vised Williston's key. Each of these, while superior to its predecessor, left much to be desired. In 1914 Hendel published a key to the genera of the world which gives a good working basis in the establishment of generic limits. It possesses advantages over the others but even here are found several weaknesses which prevents its use without some revision. The key which I present here is modified from that of Hendel so that it will fit the North American genera, at least so far as is possible with the eastern material at hand.

#### KEY TO THE GENERA.

- A. Wings not reticulate but banded or brown-spotted or hyaline. If they are brown with larger white spots and marginal indentations so that doubt may arise, then there are also six scutellar bristles or the dorso-centrals are placed posterior to the anterior supra-alars and at the same time, the  $R_{4+5}$  vein is bristly.
- B. Dorso-central bristles always placed behind the anterior supra-alars or wanting.
- C. Scutellum with six or more marginal bristles. Front at least as broad as half the head. Cross-veins approximate. Wing markings consist of a few irregular brown spots. ... *Xenochæta* Snow.
- CC. Scutellum with two or four bristles.
- D. Proboscis geniculate, as long as the head and thorax combined; anal cell closed by the convex vein  $Cu_2$ , thus being rounded out posteriorly; wing hyaline with incomplete cross-bands. .... *Aleomyia* new genus.
- DD. Proboscis much shorter than the length of head.
- E. Head inflated so that the vertex is rounded up between the eyes. Front twice as broad as one eye, and with a trough-like depression running lengthwise, the edges of which are provided with rod-like bristles in the male.  
Straussia R. D.
- EE. Head not inflated and swollen at the vertex.
- F. Vein  $M_{1+2}$  more or less bent up at the extreme tip; cell  $R_5$  narrowed at the margin; ovipositor long and conical. .... *Anastrepha* Schiner.
- FF. Vein  $M_{1+2}$  not bent up at the extreme tip.
- G. Discal cell irregular in outline. Vein  $M_{1+2}$  is bent inward before the  $r-m$  cross-vein, thus jutting down into the discal cell. .... *Epochra* Loew.
- GG. Discal cell normal; not as in the preceding.
- H. Third joint of antenna with a sharp, awl-shaped point in front. .... *Zonosema* Lw.

HH. Third joint of antenna rounded in front. Wing with crossbands, rather than true rivulets.

Phorellia R. D.

BB. Dorso-central bristles in or in front of a line connecting the anterior pair of supra-alars.

C. Scutellum with six bristles; the basal cells R and M short, anal cell shorter than M (Compare preceding C)... *Xenochæta* Snow.

CC. Scutellum with two bristles or occasionally four, but if four, then the picture of the wing is entirely dark shining brown with hyaline marginal indentations both on the anterior and posterior margins and two or three conspicuous round spots on the disc of the wing.

D. Scutellum with a median furrow, bifurcate. Crossbands dark brown..... *Peronyma* Loew.

DD. Scutellum not bifurcate. When there are more than two scutellar bristles, the wing pattern is as described in CC.

Aciura R. D.

CCC. Scutellum with four bristles and with a wing pattern not as described in CC.

D. Vein  $R_{4+5}$  distinctly bristly from the base well along the vein.

E. Wing with four very oblique, yellow, brown-margined crossbands and with cross-veins approximate, oblique and nearly parallel..... *Tomoplagia* Coq.

EE. Wing with dark brown markings differing from above. Small cross-vein perpendicular, but the posterior cross-vein oblique. Cross-veins approximate. The crossband over the  $r-m$  cross-vein is connected in the discal cell with the brown of the wing base..... *Acidia* R. D.

DD. Vein  $R_{4+5}$  bare or nearly so.

E. Anal cell distally margined by a straight or convex  $Cu_2$  so that  $R_5$  is no drawn-out point. Cell  $R_5$  not narrowed in the margin. Face produced snout-like with a median carina. Wing with four complete crossbands. Proboscis geniculate, as long as head..... *Gonioglossum* Rond.

EE. Anal cell distally closed by the concave  $Cu_2$  and drawn out into a point.

F.  $R-m$  cross-vein placed in the middle of the discal cell.

G. Scutellum swollen. Two pairs of very stout bristles on costa, one at humeral cross-vein and the other at the end of the subcostal vein. Subcosta suddenly bent up at right angles, before the apex, making the stigma very short. Third antennal joint rounded in front..... *Stenopa* Loew.

GG. Scutellum not swollen. Third antennal joint usually



with a sharp point in front. Front as broad as one eye but longer than it is broad. .... *Rhagoletis* Loew.

FF. Cross-veins approximate, the *r-m* cross-vein placed distad of the middle of the discal cell.

G. Scutellum strongly arched, inflated and highly polished. Fly usually with a shiny black ground color but sometimes a shiny yellowish-brown.

*Procecidochares* Hend.

GG. Scutellum flattened above, not inflated, somewhat pointed posteriorly and but little shining.

H. Discal cell distinctly longer than the last segment of vein  $M_{1+2}$ . Picture of wing touching or covering the apex of this vein. .... *Terellia* R. D.

HH. Discal cell as long as the last segment of vein  $M_{1+2}$ . Picture of wing, if present, not touching the apex of this vein. .... *Neaspilota* O. S.

AA. Wing reticulate, or at least with reticular crossbands. The anterior dorso-central pair of bristles is always anterior to the first supra-alars, near to the transverse suture. Vein  $R_{4+5}$  either bare or bristly.

B. Wing very broad, more than half as wide as long; strongly convex margin.

C. Wing with proximal half, brown, reticulate and distal half with yellow rivulets or crossbands. .... *Acrotænia* Lw.

CC. Wing reticulate throughout.

D. Wing dark brown with numerous but minute yellow dots and with the apex tipped by a narrow white crescent.

*Eutreta* Loew.

DD. Wing brown with numerous but conspicuous hyaline spots, almost equal amounts of the area dark and hyaline. Many rather small marginal spots. .... *Xanthomyia* new genus.

BB. Wing of normal shape or else very long and narrow.

C. Face and cheeks and usually the front with black spots and flecks. Wing rayed at the margin and with eye-spots on the disc.

*Paracantha* Loew.

CC. Face and cheeks without black spots and flecks, at most a dark spot between the antenna and eye.

D. Front much broader than half the head, three or four times as broad as one eye.

E. Third antennal joint elongate with a sharp edge in front. Face retreating. .... *Acidogona* Loew.

EE. Antennæ short, scarcely half as long as face, third joint rounded in front. Antennæ somewhat separate at base.

*Eurosta* Loew.

DD. Front narrower, at most twice as broad as one eye.

E. General color of body and wings is yellow, the latter being

a torn network of dark brown with yellow droplets. Apex and hind margin of wing is brown with only white spots. Often there is a black spot between the antenna and eye.

Icterica Lw.

EE. Wing with a brown to blackish network upon a hyaline or white ground or vice versa.

F. Apex of cell  $R_5$  broadly and deeply hyaline, at most with a narrow brown border to the veins.

G. The dark reticulation extending over two thirds of the wing. Scutellum with four bristles. Abdomen comparatively heavy and robust, generally wider than the thorax and, as a rule, shorter, although sometimes in the female, the abdomen nearly equals it in length. . . . . **Euaresta** Loew.

GG. The dark reticulation covering only a small portion of the area, not more than a third, and never extending into the costal cell. Scutellum has either two or four bristles, and the abdomen is more elongate, generally narrower and longer than the thorax.

**Trypanea** Schrank.

FF. Apex of cell  $R_5$  not broadly and deeply hyaline, hence no stellate reticulation on the tip of the wing.

G. Proboscis greatly elongate, labellæ geniculate and equaling the head in length. Cheeks and genæ very narrow. Two or three lower fronto-orbitals. Mouth margin strongly projecting. Front averages longer than broad. . . . . **Ensina** R. D.

GG. Proboscis of normal length, labellæ short or if somewhat elongate and geniculate, it is then shorter than the head. Vein  $R_{4+5}$  bare or indistinctly bristly.

**Euribia** Hend.

Genus **XENOCHÆTA** Snow. 1894.

Genotype, *Xenochæta dichromata* Snow.

Genus **ALEOMYIA** new genus.

Genotype, *Aleomyia alpha* new species.

This genus is quite distinct from others by reason of its elongate geniculated proboscis which if straightened out would measure at least the length of the head and thorax combined. The anterior pair of dorso-central bristles are placed far behind the line connecting the anterior supra-alars. The wing venation is likewise characteristic, the *r-m* cross-vein being placed before the middle of the discal cell and the anal cell being closed posteriorly by the convex  $Cu_2$ . The wing

pattern is made up of more or less isolated spots, or interrupted cross-bands. Its nearest relative is found in the genus *Gonioglossum* Rond., but the characters described above and particularly the length of the proboscis and the position of the dorso-central bristles will readily distinguish it.

***Aleomyia alpha* new species. Fig 1.**

Clay-yellow with the tip of the ovipositor black, and in the male with the lateral edges of the abdomen of a dark brown color. Dorsum of thorax and front both with a glistening golden pollen and the whole body, with the exception of the head, everywhere covered with fine black hairs. Face projecting, snout-like; proboscis greatly elongated and geniculated. Antennae short and covered with a shining silvery pollen. Front twice as broad as one eye, trough-like with the lateral edges raised. These ridges bear two pairs of stout black lower fronto-orbitals as well as a row of fine black hairs margining the eye. The scutellum is unicolorous, honey-yellow and bears four black bristles. Abdomen is densely clothed with black hairs. Ovipositor golden brown at base and black at the tip, the whole being at least four fifths as long as the abdomen; the proximal half is conical but there becomes suddenly constricted, leaving the distal section only half as wide as the proximal and hardly tapering towards the rather blunt end. The hyaline wings are of normal size and shape with several light-brown spots which tend to form more or less distinct bands, particularly in the male. One narrow, pale band crosses the wing in the vicinity of the humeral cross-vein; another elongated spot at distal end of cell M and anal cell; a third extends from the yellow stigma across the *r-m* cross-vein and the discal cell and for a short distance into cell  $Cu_1$ , being darkest in cell  $R_1$  and at the point where it crosses the *r-m* cross-vein, and almost interrupted in cell  $R_3$  and discal cells; another small spot bisects cell  $R_1$ , extending from the anterior margin to vein  $R_{2+3}$ ; a fifth elongated spot extends across the wing in the region of the *m* cross-vein which it completely covers; in the male, this spot or line is widely interrupted in cell  $R_3$  but continues from before the vein  $R_{4+5}$ , through cell  $R_5$ , over vein  $R_{2+3}$  and through cell  $R_1$  to touch the anterior margin slightly before the tip of vein  $R_{2+3}$ . In the male this fifth band is more or less continuous from the anterior to the posterior margin of the wing. The sixth spot covers the apex of the wing, extending across the tip of cell  $R_5$  and slightly into cell  $R_3$  on one side and into cell  $2dM_2$  on the other. Vein  $R_{4+5}$  is not bristly, the *r-m* cross-vein is before the middle of the discal cell and both cross-veins are perpendicular. The vein  $Cu_2$  is convex. Female 5.5 mm., male 4.5 mm. Described from three males and six females taken on sunflower at Plummer's Island, Maryland, by R. C. Shannon on the 5th of August, 1913, and the 29th of August, 1915; by J. C. Crawford on the 14th of August, 1916.

Genus **STRAUSSIA** R. D. 1830.

Genotype, *Straussia longipennis* Wied.

The members of this genus are distinctly yellow with long bodies and rather remarkably shaped heads. The whole head is swollen, especially the occiput. The lateral borders of the front are raised so that the whole front assumes the appearance of a basin. The eyes are rounded and small. The scutellum is convex, clear yellow and bears four stout and long yellow bristles. The wings are comparatively long and hyaline with a yellow or brown rivulet pattern. The veins  $R_1$  and  $R_{4+5}$  are distinctly bristly, while the  $r-m$  cross-vein is placed beyond the middle of the discal cell and the posterior angle of the anal cell is drawn out into a sharp point.

***Straussia longipennis* Wied.**

The single species in the genus is quite variable. Loew has separated it into seven varieties and I am including a key compiled from his descriptions and the specimens before me. It is not a difficult problem to pick out individual specimens that perfectly fit his varieties, but it is quite impossible to place every specimen in one of his groups. There are so many intergradations that one can practically follow every variation of the wing pattern from one variety to another, while the extremes in the different directions seem to show distinct varieties.

I have quite a series of specimens, reared by the Cornell University Experiment Station from larvæ infesting the canes of sunflower. Their wing patterns indicate that they are intermediate between *var. typica* and *var. longitudinalis*. They differ from both these varieties, however, in the fact that the upper fronto-orbital bristles in the male are not incrassated and truncate. The upper fronto-orbital bristles of some, reared in the same lot, closely resemble those of *var. typica*.

Mr. H. H. Knight reared *S. longipennis* from larvæ in canes of Jerusalem Artichoke, the tubers of which were imported from Europe. These specimens were taken at Attica, N. Y.

**KEY TO THE VARIETIES.**

- A. Of the four fronto-orbital bristles, the two upper ones are very much incrassated and truncate at the end in the male.
- B. Thoracic dorsum shows, besides the anterior end of the middle stripe,

- two well-marked black lateral stripes, interrupted at the transverse suture and pointed posteriorly. The wings of both male and female are very like var. *perfecta*. . . . . *vittigera* Lw.
- BB. Thoracic dorsum without lateral stripes.
- C. Scutellum unicolorous. The picture of the wings is not deep in coloring. . . . . *perfecta* Lw.
- CC. Scutellum with dark corners.
- D. Wing of male narrower than in all other varieties. Picture coalesces into a single broad longitudinal stripe, which is of a dirty clay-yellow color at the base and brown beyond. A spot in the costal cell is very dark in both sexes, the wing of the female otherwise being like var. *typica*. The band covering the *m* cross-vein extends to the margin. *longitudinalis* Lw.
- DD. Wing picture is complete in female but not in the male. The band covering the *m* cross-vein does not reach the margin. In both sexes, the band over the vein  $M_{1+2}$  to the margin is broader. . . . . *typica* Lw.
- AA. The upper fronto-orbitals in the male end as usual in a point. They are not incrassated and not truncate at the tip.
- B. The thoracic dorsum is without black lateral stripes. The scutellum has black corners and the metathorax has a black, elongated spot on either side. The last joint of all the feet is rather conspicuously infuscated on the sides and end. . . . . *intermedia* Lw.
- BB. The thoracic dorsum has black lateral stripes.
- C. The picture is not interrupted on the anterior margin beyond the triangular hyaline spot near the stigma. The dark band, covering the *m* cross-vein, is interrupted, thus the hyaline band between the cross-veins is connected with the clear part of the cell  $R_5$ . . . . . *arculata* Lw.
- CC. The oblique hyaline band between the cross-veins reaches the anterior margin as usual. The branch of the rivulet margining the apex of the wing and that which runs along the last section of the vein  $M_{1+2}$  coalesce in their middle. . . . . *confluens* Lw.

*Straussia longipennis* var. *perfecta* Lw. Fig. 2.

Besides the specimens which I have from Pennsylvania, New York and Colorado, this variety has also been recorded from Kansas and Connecticut.

*Straussia longipennis* var. *typica* Lw. Fig. 3.

I have numerous specimens from Pennsylvania, New York, Connecticut, Maryland, North Carolina, Illinois, Quebec, Montana, and records from Kansas and California.

*Straussia longipennis* var. *longitudinalis* Lw. Fig. 4.

My material was taken in New York, Pennsylvania and North Carolina, but it is also reported from Connecticut and Colorado.

*Straussia longipennis* var. *vittigera* Lw. Fig. 5.

I have specimens from Illinois and Montana with records from Nebraska, Kansas and California.

*Straussia longipennis* var. *intermedia* Lw. Fig. 6.

I have only a single specimen from Ithaca, N. Y.

*Straussia longipennis* var. *confluens* Lw.

Loew records this variety from Connecticut.

*Straussia longipennis* var. *arculata* Lw. Fig. 7.

My specimens are from Montana and Colorado while it is reported from Illinois.

Genus **ANASTREPHA** Schiner. 1868.

Genotype, *Anastrepha serpentina* Wied.

Genus **ZONOSEMA** Lw. 1873.

(= *Spilograpta* Loew 1873.)

Genotype, *Zonosema meigeni* Lw.

The representatives of this genus are yellow with hyaline wings that are banded with brown. The scutellum has four black bristles. They are close relatives of the genus *Phorellia*, but differ in the shape of the antennæ, the third joint of which has a sharp awl-shaped point on the front in *Zonosema*. In our eastern species, there is also a small, comma-like crossband between the two larger bands which cover the cross-veins. This small band extends from the anterior margin, through cell  $R_1$  and across vein  $R_{2+3}$  into cell  $R_3$ . The anterior pair of dorso-central bristles is noticeably behind the anterior pair of supra-alars, whereas in *Phorellia*, they are practically in a line with them.

#### KEY TO THE SPECIES.

- A. The *r-m* cross-vein is placed in the middle of the discal cell; and is perpendicular. There are four lower fronto-orbitals. The yellow scutellum has a black spot on either lateral corner and the yellowish-brown thorax has bright yellow stripes on the dorsal and lateral surfaces. The last segment of the abdomen bears a black spot on each side. Vein

- $R_{4+5}$  is bristly from the base distally to the region above the  $m$  cross-vein. .... *electa* Lw.
- AA. The  $r-m$  cross-vein is placed before the middle of the discal cell. There are three lower fronto-orbitals and the scutellum is unicolorous.
- B. Vein  $R_{4+5}$  is distinctly bristly. The anterior pair of dorso-central bristles is comparatively nearer the cephalic end than in *setosa*; if a line connecting the anterior pair of dorso-centrals were extended at the sides between the two supra-alars nearest the dorso-centrals, this line would more nearly approach the anterior pair than the posterior. The crossband which covers the  $r-m$  cross-vein is very indistinct, almost interrupted, in the discal cell. .... *flavonotata* Macq.
- BB. Vein  $R_{4+5}$  is not bristly, at most with only a couple at the extreme base and one further distad in the vicinity of the  $r-m$  cross-vein. The line connecting the anterior pair of dorso-centrals, if extended laterally, would pass midway between the anterior supra-alar and the one directly caudad. There is no interruption of the crossband in the discal cell. .... *setosa* Doane.

*Zonosema electa* Say. Fig. 8.

My specimens are from North Carolina and Maryland, but it is also reported from Florida, Georgia, Tennessee, Kansas, Indiana, Connecticut. The larvæ live in the berries of *Solanum carolinense*. The wing of a variant from Texas is shown in figure 66.

*Zonosema flavonotata* Macq. Fig. 9.

= *Zonosema basiolium* O. S.

I have specimens from New York and Massachusetts and a record from Maryland.

*Zonosema setosa* Doane. Fig. 10.

I have only a single specimen from Washington but records from Idaho, South Dakota, Michigan and Minnesota.

Genus *ACIDIA* R. D. 1830.

The general color is yellow or light brown and our eastern species, at least, have minute black or dark brown punctures in various places on the body. They are seen on the front and vertex, upon the dorsum of the thorax and abdomen and upon the scutellum. They are often wanting in some of these regions but never in all at one time. The third antennal joint is rounded in front. The anterior pair of dorso-centrals is about in a line with the anterior supra-alars. The yellow scutellum has four black bristles. The wings are hyaline with light brown rivulets, vein  $R_{4+5}$  being bristly.

## KEY TO THE SPECIES.

A. The cross-veins are approximate. The punctures on the body are black, and the wing has a rather complicated rivulet pattern as in the figure.

fratria Lw.

AA. The *r-m* cross-vein is placed in the middle of the discal cell. The punctures are brown and the wing has a dark-brown S-shaped rivulet.

sigma new species.

*Acidia fratria* Lw. Fig. 11.

My specimens are from District of Columbia, New York and California and it is reported from Washington, New Hampshire, New Jersey and Missouri. The larvæ mine in the leaves of parsnip.

*Acidia sigma* new species. Fig. 12.

Clay-yellow with numerous dark brown spots on the head, dorsum of thorax and abdomen and on the scutellum. The bristles of the head are stout and black while the antennæ are yellow with the arista darker at the tip. The dorsum of the thorax is shining yellowish-brown with many small black hairs. The anterior dorso-central bristles are in a line with the anterior supra-alars and the scutellum has four black bristles. The abdomen is densely covered with black punctures with a black hair in each, while the ovipositor is golden brown, conical, about as long as the last two segments taken together. The legs are yellow and the wings hyaline with a brown rivulet pattern. Vein  $R_{4+5}$  is bristly as far as the *r-m* cross-vein. The cross-veins are approximate, the *r-m* perpendicular, the *m* cross-vein oblique. Base of the wing is somewhat yellowish and the brown rivulet forms a complete S on the distal half. One end of the S fills the stigma and crosses the *r-m* cross-vein to the posterior margin, there turning back to cover the *m* cross-vein and reaching the anterior margin slightly beyond the middle of cell  $R_1$  and from there following around the tip of the wing as an apical band as far as the tip of cell  $2dM_2$ .

Two female specimens, collected by R. C. Shannon, Plummer's Island, Maryland, June 20, 1916. Length 5.5 mm. The holotype is placed in the collection of the United States National Museum, the paratype in that of Cornell University.

Genus **GONIOGLOSSUM** Rond.

Genotype, *Gonioglossum wiedemanni* Meig.

Genus **PHORELLIA** R. D. 1830.

(= *Spilographa* Lw.)

Genotype, *Phorellia artemisia* Fabr.

This genus differs from *Zonosema* in having no sharp awl-shaped point on the front of the third joint of the antenna, although this joint may be more or less tapering towards its end. There is no small cross-



band between the bands that cover the cross-veins. The anterior pair of dorso-central bristles is in a line with the anterior supra-alars.

*Phorellia tortilis* Coq. Fig. 13.

This is a pale-yellowish species which has three lower orbitals. The small cross-vein is in the middle of the discal cell and vein  $R_{4+5}$  is very sparingly bristly.

A single specimen loaned me by C. W. Johnson was taken at Bretton Woods, N. H., but it is also reported from Washington.

Genus **PERONYMA** Lw. 1873.

Genotype, *Peronyma sarcinata* Lw.

*Peronyma sarcinata* Lw. Fig. 14.

The species differs very materially from any others in this region. The flies are reddish-brown and always dark in general color. The scutellum is unique, being shining black, swollen and bifurcate. Each division thus made bears a single stout black bristle and, contrary to Mr. Loew's opinion, I can discover no trace of the existence of another smaller pair. The wings are rather long and heavy, being hyaline with broad, dark-brown oblique bands, the second of which covers both cross-veins. The cross-veins are oblique and approximate. The discal cell is peculiarly shaped, wide and rounded distally and considerably tapered at the proximal end.

One specimen from Alabama was loaned by R. C. Shannon and it is also reported from South Carolina. I thought it well to include this species in my study as the genus is so distinct and because its range is close to our limits.

Genus **ACIURA** R. D. 1830.

There seems to be even more confusion in this than in other genera of this family. Hendel adopts three genera of this group, *Aciura*, *Xanthaciura* and *Tetraciura*. Our eastern species that have four scutellar bristles and an anal cell that is drawn out posteriorly will fit into none of these. Our species seem to possess some of the characteristics of each of Hendel's genera and therefore it would be much simpler and bring the species together in truer relationship if we used the one old genus *Aciura*. The others would then fall into line as subgenera and the puzzle of where to place our species be solved by the erection of a new subgenus.

The chief characteristic of the genus *Aciura* would then be its peculiar wing pattern. It is shining black without any clear or yellow punctures. There are, however, upon both the anterior and posterior sides, triangular marginal indentations and one to three clear round spots on the disc.

*Trypeta nigriventris* Macq. was described from material recorded from Baltimore. It doubtless belongs to the genus *Aciura*.

#### KEY TO THE SUBGENERA.

- A. Two bristles on the scutellum.
  - B. Postocular cilia black or dark. .... *Aciura* Hend.
  - BB. Postocular cilia yellow. .... *Xanthaciura* Hend.
- AA. Four bristles on the scutellum.
  - B. Anal cell distally margined by a straight or convex  $Cu_2$  so that there is no drawn-out point. .... *Tetraciura* Hend.
  - BB. Anal cell margined by a concave  $Cu_2$  so that the cell is drawn out into a distinct point. .... *Eucosmoptera* new subgenus.

#### KEY TO THE SPECIES OF THE SUBGENUS EUCOSMOPTERA.

- A. Vein  $R_{4+5}$  bristly. Front broad, with the lateral borders raised, which in the male bear three large black spines and two bristles. The postocular bristles are black. The body is wholly reddish-yellow with the exception of the abdomen. This is entirely shining black in the male, while the extreme tip and the ovipositor are black in the female. The wings are broad, the  $m$  cross-vein perpendicular. .... *nigricornis* Doane.
- AA. Vein  $R_{4+5}$  not bristly.
  - B. The  $m$  cross-vein is very oblique and the wing broad. The disc has a single hyaline spot which is situated in the discal cell and crosses vein  $Cu_1$  so that it slightly enters cell  $Cu_1$ . The body is reddish-yellow and polished. .... *limata* Coq.
  - BB. The  $m$  cross-vein is perpendicular, and the wing comparatively long and narrow, with three spots on the disc. The thorax and the tip of the abdomen are black, the rest of the body being reddish-yellow, while the whole is shining where not covered with grey pollen.
    - tetraspina* new species.

*Aciura* (*Eucosmoptera*). *nigricornis* Doane. Fig. 15.

In the original description Mr. Doane mentions that there are only two strong bristles on the scutellum. He further states that the abdomen is missing. I have two specimens, a male and a female, both from New York, each of which has four prominent scutellar bristles. Mr. R. C. Shannon examined the material in the United States National Museum, three specimens from Massachusetts and New Hamp-

shire, and reports four scutellar bristles on these specimens. These facts lead me to believe that one pair of the bristles had been broken from the type specimen along with its abdomen. It is reported from Pennsylvania and Vermont.

*Aciura (Eucosmoptera) limata* Coq. Fig. 17.

The wing figure of this species was drawn by Mr. M. E. Phillips from the specimen in the U. S. National Museum. It has been reported only from Massachusetts.

*Aciura (Eucosmoptera) tetraspina* new species. Fig. 16.

Front golden yellow, only two thirds as wide as one eye. Bristles of head dark brown or black, occipital row quite heavy and white and another row of much smaller white pile margining the eye on the front. Antennæ honey-yellow, arista brown. Face pale yellow, somewhat retreating. Thorax grey-pollinose, densely covered with white stubble-shaped pile and long yellow bristles. Scutellum also grey-pollinose with four yellow bristles, the pair near the lateral corners being very long, at least three times as long as the central pair. The proximal half of the abdomen and the feet are shining brownish-yellow, and with the shining black distal half of the abdomen are covered with yellowish-brown hairs. The wing closely resembles that of *T. insecta* Lw., figured by van der Wulp. The pattern shows a shining longitudinal black band running the length of the wing with two hyaline indentations through the costal cell, and two larger ones in cell  $R_1$  beyond the stigma. Cell  $2dM_2$ , likewise, has two deep hyaline indentations and proximad of this, the edge of the dark band follows approximately vein  $Cu_1$ . The edge is wavy with four points of dark jutting down into the hyaline. The disc of the wing bears three round hyaline spots, two in cell  $R_5$ , one before and one after the  $m$  cross-vein, and the third in cell  $R$ . Vein  $R_{4+5}$  is bare. Male 2.5 mm., female 3.5 mm.

Described from two males and three females collected by C. R. Crosby in Columbia, Mo., 26 May-8 June, 1906.

Genus **TOMOPLAGIA** Coq. 1910.

(= *Plagiotoma* Lw. 1873.)

Genotype, *Tomoplagia obliqua* Say.

The chief characteristics of this genus are found in its four-bristled scutellum and in the peculiarities of the wing. The latter are rather large with a distinctly convex anterior margin. The cross-veins are oblique and approximate. Vein  $M_{1+2}$  is bowed up beyond the  $m$  cross-vein. Vein  $R_{4+5}$  is very conspicuously bristly from the base well beyond the  $m$  cross-vein. The picture of the wing consists of four very oblique cross bands, the second of which covers both cross-veins.

*Tomoplagia obliqua* Say. Fig. 18.

Specimens from California and Arizona, but it is recorded from Pennsylvania, Indiana, Illinois, Iowa, New Jersey, Texas and Kansas. The adults were taken on *Vernonia* in August by Osten Sacken.

Genus **EPOCHRA** Lw. 1873.Genotype, *Epochra canadensis* Lw.

This genus has much in common with *Acidia* and, like it, has the dorso-central bristles placed behind the anterior supra-alars. The flies have the same general color, yellow or pale brown, but lack the dark punctures. The yellow scutellum has four bristles. The hyaline wing could scarcely be considered as rivuleted, although it is indicative of that pattern. Vein  $R_{4+5}$  is bristly and vein  $M_{1+2}$  has a peculiar bend before the *r-m* cross-vein which causes it to project down into the discal cell. The dark band which covers the *m* cross-vein is not connected with the brown of the wing base.

*Epochra canadensis* Lw. Fig. 23.

My specimens are from Lorenzo, Cal., and Orono, Maine, but it has also been taken in Canada, Washington, Colorado and British Columbia. The larvæ feed in berries of currants and gooseberries.

Genus **STENOPE** Lw. 1873.Genotype, *Stenopa vulnerata* Lw.*Stenopa vulnerata* Lw. Fig. 20.

This is a black fly covered with grey almost stubble-shaped pile. The shining black scutellum is swollen and bears four black bristles. The wing is hyaline, large and broad with black rivulets. Vein  $R_{4+5}$  is bare and is bent down toward its apex so that the margin of cell  $R_5$  is narrowed. The stigma is likewise peculiar, being as deep as long, on account of a sudden turning up of vein  $R_1$ . The presence of two pairs of heavy costal spines seems to be unique. These are situated, one at the humeral cross-vein and the other at the end of the subcostal vein.

The specimens are from Nance, North Carolina, but it is reported from Massachusetts, Connecticut and Tennessee.

Genus *RHAGOLETIS* Lw. 1862.Genotype, *Rhagoletis cerasi* Linn.

Most of the species in this genus have black bodies and hyaline, black-banded wings. *R. suavis* Lw. is an exception, however, and has a yellow head, thorax and feet, but with a dark-brown abdomen. The wings are of the same general plan, hyaline with dark-brown bands or rivulets. The front is as broad as one eye, but longer than broad in all species. The third joint of the antenna usually has a point in front. The four-bristled scutellum is either whitish yellow or has a conspicuous yellow spot. Vein  $R_{4+5}$  of the wing is bare, or with two or three minute bristles at the base. The *r-m* cross-vein is in the middle of the discal cell.

## KEY TO THE SPECIES.

A. Wings with a hyaline band extending completely across between the two cross-veins.

B. A clear hyaline band extending across the wing from the costal cell over the distal end of basal cell M.

C. The last two of the four bands is connected in the shape of an inverted V, the last margining the apex of the wing to beyond the tip of  $M_{1+2}$ , except for the presence of a minute hyaline crescent on the extreme edge for a part of the distance. The picture of the thoracic dorsum differs from *R. tabellaria*. It is mostly covered with grey pollen, so that the intervening shining black stripes are very narrow. The scutellum differs from *R. cingulata*. In the present species it is shining black with only a clear white spot on dorsum. . . . . *juniperinus* Marc.

CC. The apex of the wing has a black spot which is generally separated from the last crossband although sometimes it is connected between the veins  $R_{2+3}$  and  $R_{4+5}$ . The scutellum is almost wholly yellow, the black appearing only as dark lateral corners.

*cingulata* Lw.

BB. The first two bands of the wing are connected on the posterior margin, the last two on the anterior margin, thus giving the wing the appearance of having a V and an inverted V. The picture of the thoracic dorsum is composed of four rather narrow stripes covered with grey pollen. All four stripes are short, the two central ones being only half the length of the thorax and the lateral, which are widely interrupted at the suture, even shorter. The intervening black spaces are about the same width as the stripes.

*tabellaria* Fitch.

AA. Wings without a clear hyaline band extending from the anterior to the posterior margin, between the cross-veins.

B. A separate branch, coming off from the main rivulet pattern, covers the *m* cross-vein.

C. The wing is without an apical hyaline crescent. There is a deep marginal triangle beyond the stigma which extends below vein  $R_{4+5}$ , and a clear, hyaline band running across the wing from the costal cell over the apex of basal cell M. The body is yellow with a brown abdomen. .... *suavis* Lw.

CC. The wing has an apical hyaline crescent. Instead of a hyaline triangle beyond the stigma, there is one beginning in the costal cell, whose apex extends down into the base of cell  $Cu_1$

*pomonella* Walsh.

BB. A separate branch comes off from the main rivulet pattern in the posterior apical region but does not cover the *m* cross-vein.

C. There is a conspicuous round "shot-hole" in the black of the discal cell. A hyaline triangle beyond the stigma extends down into cell  $R_m$ , and the two hyaline indentations on the posterior margin of the apical end extend well up into the wing. The proximal indentation crosses vein  $M_{1+2}$  and juts up into cell  $R_3$ , and the distal one margins the wing below vein  $M_{1+2}$  and goes back across cell  $R_5$  into cell  $R_8$ . .... *fausta* O. S.

CC. The wing is without a "shot-hole" in the black of the discal cell. The hyaline triangle beyond the stigma is produced toward the posterior margin between the cross-veins and well into cell  $Cu_1$ . The proximal indentation on the posterior margin occupies about half of cell  $2dM_2$  without crossing vein  $M_{1+2}$ . The distal indentation margins the wing below vein  $M_{1+2}$  and curves up into cell  $R_8$  and touches, but does not cross, vein  $R_{4+5}$ .

*striatella* v. d. W.

***Rhagoletis juniperinus* Marc. Fig. 19.**

My specimens are from Six Mile Creek, Ithaca, New York, where Mr. Marcovitch found the larvæ living in the berries of *Juniperinus virginianus*.

***Rhagoletis cingulata* Lw. Fig. 22.**

Although my specimens are all taken in New York, this species is also reported from the Middle States, New Jersey and Massachusetts. The larvæ live in cherries and do considerable damage in some localities.

***Rhagoletis tabellaria* Fitch. Fig. 21.**

The specimens are from Hamburg, New York, Washington and Nebraska and it has been taken in Canada. The Washington specimen was taken on Western Tall Blueberry.

**Rhagoletis suavis** Lw. Fig. 24.

I have material from Plummer's Id., Maryland, and from New York. In some regions this species does much damage to Black Walnuts, the larvæ living in the outer husks of the fruits.

**Rhagoletis pomonella** Walsh. Fig. 25.

This species is rather widely distributed over the northeastern states, occurring in South Dakota, North Dakota, Michigan, Illinois, New Jersey, New York, Massachusetts, Maine and Nova Scotia. The young live in fruit of apple, *Cratægus*, blueberry and cranberry.

**Rhagoletis fausta** O. S. Fig. 26.

My specimens are taken in New York but it is reported from New Hampshire and British Columbia where the larvæ do considerable damage to cherries.

**Rhagoletis striatella** v. d. W. Fig. 27.

Mr. C. W. Johnson writes me that he has one specimen from Illinois but the species was described from Mexican material.

Genus **PROCECIDOCHARES** Hendel. 1914.

(= *Ædaspis* Lw.)

Genotype, *Procecidochares atra* Lw.

Most of the species of this genus are shining black, although *P. penelope* O. S. is of a shining yellow and brown color instead, and pretty generally covered with white or yellowish stubble-shaped pile. The scutellum is always black, shining, greatly swollen, and bears four bristles. The wings are hyaline with heavy brown or black crossbands or rivulets. The cross-veins are greatly approximated and vein  $R_{4+5}$  is bare.

## KEY TO THE SPECIES.

- A. The lower fronto-orbital bristles are set well back from the eye, almost the width of the third antennal joint from its margin. The front is broad, generally over twice the width of one eye and is very pale yellow or white. The front, face, genæ, and cephalic region are densely covered with white stubble-shaped pile. The femora are yellow or very pale brown. .... *polita* Lw.
- AA. The lower fronto-orbitals are very close to the eye. The front is conspicuously narrower.
  - B. The basal black spot of the wing does not extend proximad of the

humeral cross-vein. The third crossband is definitely connected on the anterior margin with those forming an inverted V with its apex in the stigma. A shadowy, triangular spot in the hyaline of cell Cu<sub>1</sub> is quite characteristic. The cross-veins are neither curved nor parallel. . . . . *penelope* O. S.

BB. The basal spot covers the humeral cross-vein and extends as far proximad as distad of it. The third black band is not connected with the inverted V.

C. The cross-veins are straight and parallel. The femora are black and the rest of the feet and legs yellow. There are three pairs of dorso-centrals, the anterior placed before the suture but not laterally situated as are the presuturals. The wing pattern resembles that of *P. atra*. . . . . *setigera* Coq.

CC. One or both of the cross-veins are curved and they are not parallel. Two pairs of dorso-centrals. . . . . *atra* Lw.

I can find no constant character by which to separate *P. atra* and *P. anthracina*. My eleven specimens vary so much in structural characters that I hesitate to use color separations. The legs of *P. atra* have dark brown or black femora with the rest of the legs and feet yellow, except a darker spot on the tip of the tarsus. *P. anthracina* seems to have lighter legs and no dark tarsal tip. The two wings of one specimen vary as regards exact position and direction of many veins. The bristles on the head and thorax are not constant, the lower fronto-orbitals varying from two to four pairs. The lower pair of the superior fronto-orbitals is not infrequently replaced by a cluster of two or three and the scutellum itself, in one instance, bears six bristles. Several of my specimens of *Procecidochares* possess the supernumerary cross-vein which Loew mentions in his description of *T. gibba*, and I feel certain that the whole group is irregular and that his *T. gibba* is a freak of *P. polita* Lw.

*Procecidochares polita* Lw. Fig. 28.

I have several specimens from Pennsylvania, Kansas and Georgia. It has, however, a rather wide eastern distribution, being reported from Mississippi, New York, Connecticut, New Jersey and from the District of Columbia. This species forms the Leafy Rosette Gall of the Goldenrod (*Solidago altissima*).

*Procecidochares penelope* O. S. Fig. 29.

The single specimen was taken at Manlius, New York.



*Procecidochares setigera* Coq. Fig. 30.

My one specimen, loaned by the U. S. Nat. Mus., was without a locality label. It is recorded from Rhode Island, Virginia, Georgia, Missouri and Kansas.

*Procecidochares atra* Lw. Fig. 31.

= *Procecidochares anthracina* Doane.

This species was taken in New York, Georgia and Nova Scotia.

Genus **TERELLIA** R. D. 1830.

(= *Trypeta* Lw.)

Genotype, *Terellia serratulæ* Linn.

These flies have very peculiarly shaped heads, which are more or less globular, puffed and rounded out in all directions. The lower fronto-orbitals are black and strong, the third pair from the antenna always being long enough to cross in the centre of the front, and this seems to be the characteristic position. They are quite heavy bodied flies, the head being wider than the thorax. The flattened scutellum bears four bristles. The wing is hyaline with a yellowish or grayish pattern of bands which are sometimes interrupted. The cross-veins are approximate and vein  $R_{4+5}$  is bare. The picture touches or covers the tip of vein  $M_{1+2}$ .

#### KEY TO THE SPECIES.

- A. Picture of the wings with a band margining the apex and covering the apices of veins  $R_{2+3}$ ,  $R_{4+5}$ , and  $M_{1+2}$ . The yellow scutellum has dark lateral spots. A dark band extends from the anal cell region along vein  $Cu_1$  to or almost to the  $m$  cross-vein. .... **palposa** Lw.
- AA. No apical band as described above.
  - B. The wing is clear from base as far distad as the stigma. A yellow species with yellow or pale brown bristles. The picture on the wing is pale or scattered, almost reticular. The wing is more or less milky and the abdominal segments are unicolorous. ... **vernoniæ** Lw.
  - BB. Basal region of the wing not clear as far as the stigma. This is a yellowish-gray species, much darker than the preceding, with a black ground color, covered with a yellowish-white pollen. The abdomen has four rows of black spots. Wings bear four dark-grey spots surrounded by clear hyaline spaces and with shadowy markings variously distributed. .... **florescentiæ** Linn.

*Terellia palposa* Lw. Fig. 32.

My specimens are from Ohio but it is recorded from Wisconsin, Minnesota, Iowa, Massachusetts and Kansas. Mr. Johnson reports,

"Common on thistle, *Cnicus pumilus*, at Hyannis Port, Mass., July 4, 1904."

*Terellia vernoniæ* Lw. Fig. 33.

I have a single specimen from North Carolina. It has been recorded from Pennsylvania and New Jersey, the adult being taken on *Vernonia*.

*Terellia florescentiæ* Linn. Fig. 34.

= *Terellia ruficauda* Lw.

The many specimens in this collection were collected in Nova Scotia and New York. It is reported from Canada, Maine and Massachusetts. Several adults emerged in captivity in November from infested thistle heads.

Genus **NEASPILOTA** O. S. 1878.

(= *Aspilota* Lw.)

Genotype, *Neaspilota alba* Lw.

The species of this genus are small flies whose bodies are covered with fine white or yellow pile. The head is generally about the same width as the thorax. The bristles of the head are weak; particularly the lower fronto-orbitals, the third pair from the antennæ never long enough to cross in the centre of the front. The thoracic dorsum usually has a dark pattern covered by the pollen and the yellow scutellum bears four bristles. The wings are without pattern or nearly so and are milky white. The cross-veins are approximate and vein  $R_{4+5}$  is bare.

#### KEY TO THE SPECIES.

- A. Wings are entirely clear, including the stigma. The body is a very pale yellow and covered with white pile. The veins of the wing are not dark colored. .... **alba** Lw.
- AA. The wings are not entirely clear, the stigma at least being colored.
  - B. The stigma only is brown while the rest of the wing is clear. The body is grey, covered with white pile. The veins of the wing are colored brown. .... **albidipennis** Lw.
  - BB. The wing has a black spot through the stigma and also various dark spots on the apical half. These are arranged more or less in the form of interrupted bands. .... **achilliæ** John.

*Neaspilota alba* Lw. Fig. 35.

I have specimens from New York and Texas. It has been taken in Pennsylvania, New Jersey, Missouri and Colorado. The adults were

captured on Iron weed (*Vernonia noveboracensis*) and bred by Riley from the seeds of *Vernonia*.

*Neaspilota albidipennis* Lw. Fig. 36.

My specimens are from Pennsylvania and Massachusetts. In New Jersey, the adults were taken on *Vernonia*.

*Neaspilota achillæ* John. Fig. 37.

I have only two specimens, both from Wood's Hole, Massachusetts. It is reported from Pennsylvania and Georgia and the adults have been taken on Yarrow (*Achillea millefolium*).

Genus **ACROTÆNIA** Lw. 1873.

Genotype, *Acrotænia latipennis* Wd.

Genus **XANTHOMYIA** new genus.

Genotype, *Xanthomyia platyptera* Lw.

The wing is reticulate, very broad, more than half as wide as long, with a strongly convex margin. It is dark gray, almost black at times and with innumerable hyaline droplets throughout. Cross-veins are approximate, perpendicular and parallel. The scutellum bears four bristles.

*Xanthomyia platyptera* Lw. Fig. 38.

This is a gray species with yellow legs and head. A black transverse streak occurs on the border of the eye and the bristles of the front are inserted each in a dark puncture. The thorax is gray pollinose and the black bristles likewise inserted on black spots. The scutellum is variegated brown and yellow, while the abdomen bears four rows of black spots. The wings are reticulate, the stigma black with two hyaline spots. The entire margin of the wing has a more or less continuous row of hyaline spots separated by bands of the dark running to the margin.

All my specimens were taken in New York but it is recorded also from Connecticut.

Genus **EUTRETA** Lw. 1873.

Genotype, *Eutreta sparsa* Lw.

These dark-brown flies are stout with large and broad brown wings. The front is wide and has the usual number of bristles, which are

rather stout and black. The postocular row is composed of short black bristles and somewhat longer white stubble-shaped bristles interspersed. The black scutellum has four black bristles. The wings are a dense, dark-brown color with a narrow white crescent-shaped tip, the brown being minutely punctured with yellowish-white spots.

#### KEY TO THE SPECIES.

- A. Vein  $R_{4+5}$  is bristly. The stigma is without any yellow punctures but there is a small marginal patch of yellow around the apex of vein  $R_1$ . The face is very pale with several black spots; the body brown. *sparsa* Wied.
- AA. Vein  $R_{4+5}$  is not bristly and the face is without black spots.
- B. The apical white crescent of the wing is divided into several sections by spurs of the brown coloring. The stigma has one or two yellow punctures. The body is brown, and somewhat smaller than *sparsa*. . . . . *rotundipennis* Lw.
- BB. The white crescent is complete and the stigma without yellow punctures. There is no marginal yellow patch at the tip of vein  $R_1$ . The thorax and legs are shining black, the former with white pile. The abdomen is bright reddish brown. . . . . *diana* O. S.

#### *Eutreta sparsa* Wied. Fig. 39.

The specimens are from New York and Nova Scotia and it is reported from Massachusetts, Maine, New Jersey, Pennsylvania, Indiana, Wisconsin, South Dakota, Colorado, California, Washington and Texas. The larvæ live in root galls on goldenrod.

#### *Eutreta rotundipennis* Lw. Fig. 43.

A single specimen from Plummer's Island, Maryland, was loaned by Mr. R. C. Shannon. It has also been reported from New Jersey. Mr. C. W. Johnson writes me that Loew's type was from Texas rather than "Middle States" as recorded in his Monograph.

#### *Eutreta diana* O. S. Fig. 41.

I have one specimen from Montana and one from California. It has been taken in Missouri, Nevada, Nebraska and Washington. The larvæ live in galls on *Artemisia tridentata*.

Genus **PARACANTHA** Lw. 1873.

(= *Carpotricha* Lw.)

Genotype, *Paracantha culta* Lw.

The adults are robust, pale brown flies with white hairs. The body is variously spotted with dark brown or black, especially at the

insertion of the bristles. The face and front have several black spots and flecks. The two pairs of lower orbital bristles, the ocellars and the two pairs of vertical bristles are all black and, with the exception of the outer vertical pair, are all stout. A postocular row of small black bristles is intermixed with white ones. All others of the front and occiput are white and weak. The yellow scutellum is covered with white stubble-shaped pile and bears four black spots for the insertion of the bristles. The wing is large, light brown in color and rayed at the margin from the base along the anterior margin to the tip of vein  $Cu_1$ . A prominent black eye-spot appears in cell  $R_5$ . Vein  $R_{4+5}$  has two or three weak bristles on the upper side of the wing but is distinctly bristly on the lower side.

*Paracantha culta* Wied. Fig. 42.

My specimens are from New Mexico, Georgia, Nebraska, Colorado and Texas. It has also been reported from Washington, Oregon, Idaho, South Dakota, California, Kansas and Carolina.

*Paracantha marginepunctata* Macq.

This was described from material recorded from Baltimore; but with a very meagre description.

Genus **ACIDOGONA** Lw. 1873.

Genotype, *Acidogona melanura* Lw.

Loew points out that the characteristics of this genus are found in "the striking breadth of the forehead, the unusual length of the antennæ, and the comparatively very even face, somewhat retreating below."

*Acidogona melanura* Lw. Fig. 40.

This species is clay-yellow with reticulate wings. The yellow scutellum has four bristles and vein  $R_{4+5}$  is distinctly bristly. Loew described the species from material taken in the District of Columbia and I have copied his figure of the wing to include with my figures as I have no specimens, nor any other records of its capture.

Genus **EUROSTA** Lw. 1873.

Genotype, *Eurosta solidaginis* Fitch.

In this genus are found the largest and heaviest of our eastern Trypetidæ. They have reddish-brown bodies and dark reticulate

wings that are more or less finely punctured with yellow and have varying amounts of hyaline on the margins. The front is very broad, three or four times as broad as one eye; cheeks also broad. The dark scutellum has either two or four bristles, while the ovipositor is heavy and conical. The wings are broad with a very obtuse tip and vein  $R_{4+5}$  with bristles.

#### KEY TO THE SPECIES.

##### A. Scutellum with two bristles.

B. Conspicuous hyaline indentations are present on the margin of cell  $2dM_2$ , some of which are as deep as the *r-m* cross-vein.

C. There is a large and black elongated spot in cell  $R_5$  which fills two thirds of that cell. The margin of the wing is rayed from considerably before the stigma, around the apex to the tip of vein  $Cu_1$ . There is no single large hyaline triangle occupying the most of cell  $Cu_1$  and extending up into the discal cell.

*latifrons* Lw.

CC. No large and dark elongated spot in cell  $R_5$ . The margin of the wing may be considered as rayed only at the extreme tip, if at all. A large hyaline triangle is present, margining cell  $Cu_1$  and occupying at least two thirds of that cell, and extending up into the discal cell. .... *solidaginis* Fitch.

BB. All marginal indentations in the second  $M_2$  cell are minute.

C. A triangular hyaline spot on the anterior margin just beyond the stigma. The dark comma mark in the centre of this indentation which is present in the next species is absent here. The ovipositor is more or less attenuated near the apex and finely ridged transversely. The wing is pretty uniformly dark brown with numerous yellow punctures. A very narrow white crescent edges the extreme tip and there is a suggestion of a white marginal indentation at the apex of vein  $Cu_2$ . .... *elsa* Daecke.

CC. The white hyaline triangular indentation just beyond the stigma has a dark comma mark through it, running from the margin to vein  $R_{2+3}$ . The ovipositor is smooth and uniformly conical. This species has a small hyaline indentation over the tip of vein  $Cu_2$  and also a narrow white crescent on apex. *comma* Wied.

##### AA. Scutellum with four bristles.

B. The *r-m* cross-vein is oblique and the stigma has two spots, one yellowish and the other white. Several hyaline spots are more or less rayed about the apex, with a suggestion of a dark spot in cell  $R_5$  which shows only in certain lights. The body is somewhat smaller than that of the following species. .... *conspurcata* Doane.

BB. The *r-m* cross-vein is perpendicular, but this species also has two spots in the stigma. The hyaline spots and spaces are smaller than in *conspurcata* and the small yellow punctures are more numerous.

*reticulata* Snow.

**Eurosta latifrons** Lw. Fig. 44.

Two specimens were loaned by Mr. C. W. Johnson, one from St. Albans, Vermont, and one from Springfield, Massachusetts. It is reported from Carolina, Connecticut and New Jersey.

**Eurosta solidaginis** Fitch. Fig. 45.

I have many specimens from New York and Ohio. It has, however, a rather wide distribution, being reported from Maine, Connecticut, New Hampshire, New Jersey, Kansas, Minnesota, Nebraska, Idaho, Colorado, Washington and Canada. The larvæ live in the round galls of the goldenrod.

**Eurosta elsa** Daecke. Fig. 46.

My specimens are from Ithaca, Long Island, and Forest Hills, New York, and the species is recorded from Maryland. The larvæ live in root galls of the goldenrod (*Solidago rugosa*).

**Eurosta comma** Wied. Fig. 47.

This species is represented by specimens from Colorado, New York and Maine but occurs also in New Jersey, Connecticut, Maryland, Virginia, Kentucky and Washington. Like *elsa* this species also forms root galls on goldenrod but chooses a different species for its host (*Solidago juncea*).

**Eurosta conspurcata** Doane.

I have specimens from Ithaca and Rock City, New York, and it is reported from New Jersey, New Hampshire and Washington.

**Eurosta reticulata** Snow. Fig. 48.

Dr. A. L. Melander very kindly loaned me a specimen of this species and I have also one from New York State. It has been taken in Massachusetts, Connecticut, Minnesota, South Dakota, Montana and Colorado.

Genus **ICTERICA** Lw. 1873.Genotype, *Ictericia seriata* Lw.

The whole insect, body and wings is a yellowish-brown. The anterior pair of dorso-central bristles is in a line with the anterior pair of supra-alars. The yellow scutellum bears four bristles. The wings are long with more or less parallel margins. The anterior cross-vein is somewhat oblique, that end which touches vein  $R_{4+5}$  being furthest

from the base of the wing, while the *m* cross-vein is even more oblique than the *r-m* cross-vein. Vein  $R_{4+5}$  may either be bristly or not. Our eastern species have the same general pattern of many yellow droplets on a pale brown background. A brown band margins the wing and most of the breaks and spots in it are of pure hyaline.

#### KEY TO THE SPECIES.

- A. Vein  $R_{4+5}$  is bristly for over two thirds of its length; while the dark brown or black of the anterior margin begins before the tip of the subcostal vein. This border has no hyaline interruptions between the stigma and the tip of vein  $M_{1+2}$ , although it may have two or three small yellow ones. The brown network of the centre of the wing is in the form of angular spots, triangles, squares, etc. .... *seriata* Lw.
- AA. Vein  $R_{4+5}$  with only two or three bristles at the base. The dark brown of the anterior margin begins beyond the tip of the subcostal vein and has four hyaline interruptions between the stigma and the tip of vein  $R_{4+5}$ . The brown net-work of the centre of the wing is in the form of circles and connections between round spots. .... *circinata* Lw.

#### *Icteric seriata* Lw. Fig. 49.

Three specimens are from Ithaca, New York, and it is recorded from Massachusetts, New Jersey, Illinois, Michigan and Nebraska.

#### *Icteric circinata* Lw. Fig. 50.

My representatives are from Trenton and Westville, New Jersey. It has been taken in New York. Mr. C. W. Johnson reports taking it "quite commonly on the flower heads of a wild sunflower-like plant that grew between high and low tidewater."

#### Genus *EUARESTA* Lw. 1873.

#### Genotype, *Euaresa festiva* Lw.

The species of this genus all have reticulate wings whose reticulation extends well over two thirds of the wing. The picture is rayed at the apex, invariably having a large hyaline spot on the margin of cell  $R_5$ . The scutellum bears four bristles. Vein  $R_{4+5}$  is sometimes sparingly bristly, although after examining a long series of several species, I doubt if this character is a constant one in the different members of the genus. These differ from those of the genus *Trypanea* in the shape of the body and particularly in the shape of the abdomen. In *Euaresa* it is heavy and robust, comparatively, and it



is usually wider than the thorax. In the male the abdomen is shorter than the thorax and in the female, sometimes shorter but sometimes as long as the thorax.

#### KEY TO THE SPECIES.

- A. The stigma is dark with one or two hyaline or yellow spots.
  - B. Cell  $R_5$  has a darker, almost black elongate spot in the brown of the reticulation.
    - C. Cell  $R_5$  has a conspicuous hyaline spot above the tip of the  $m$  cross-vein. The body of the female is 4-5 mm. long, entirely yellow with the exception of the long and tapering black or reddish ovipositor. The wings are hyaline with brown reticulation which is much darker in cells  $R_1$  and  $R_{2+3}$ . . . . . *festiva* Lw.
    - CC. Cell  $R_5$  has no hyaline spot except the marginal indentations. The body of the female is about 2.5 mm. long. The thorax and head are both gray pollinose while the abdomen is light brown with dark brown posterior edges to the segments and a dark ovipositor. The legs are yellow and the wings quite similar to the preceding with the exceptions already noted. . . . . *bella* Lw.
  - BB. Cell  $R_5$  has no dark elongate spot in the brown of the reticulation. The body is entirely yellow and about 5-6 mm. long in the female. The ovipositor varies from yellow to reddish-brown. The wings are hyaline with a yellow reticulation which becomes somewhat darker, almost black on the costal border and apex. The hyaline drops are very numerous and exceptionally large. . . . . *æqualis* Lw.
- AA. The stigma is wholly dark like the ground color of the wing, that is, without any hyaline spots.
  - B. The costal cell is clear hyaline without any dark spots.
    - C. A very small, grey pollinose species, with hyaline wings bearing a black pattern. Female 3 mm. long. The wing reticulation differs in having many more small hyaline spots than the next species, especially in cell  $R_5$  where there are eight of various sizes among my specimens. . . . . *angustipennis* Lw.
    - CC. This species is much larger (female 5 mm.) and yellow. The wings are hyaline with the pattern in yellow or light brown. Cell  $R_5$  has at most four hyaline spots. . . . . *subpura* John.
  - BB. The costal cell has several dark spots breaking the clear hyaline.
    - C. Cell  $R_5$  has a single conspicuous spot immediately above the posterior cross-vein, as well as a few others scattered throughout the cell. There is also a minute hyaline spot in cell  $R_1$  beyond the hyaline pyramid. Body 5 mm. long, black, with the head and legs brown. The wings are somewhat milky with black reticulations. . . . . *pura* Lw.
    - CC. Cell  $R_5$  has two conspicuous spots, one above the  $m$  cross-vein and

the other directly above the first. Cell  $R_1$  is entirely dark beyond the hyaline pyramid. .... *webbii* Doane.

***Euaresta festiva* Lw. Fig. 51.**

I have specimens from Ithaca, New York, and Fremont, Nebraska. It is recorded from Pennsylvania, Connecticut, New Jersey, Virginia, Illinois, Ohio, Quebec and South Dakota.

***Euaresta bella* Lw. Fig. 52.**

My material was taken in New York, Nebraska, Illinois and Georgia but it is reported from New Jersey, Iowa, Kansas, Michigan, Tennessee, Wisconsin and Washington. The adults are commonly taken on Ragweed.

***Euaresta æqualis* Lw. Fig. 53.**

This species is rather widely distributed since I have specimens from New York, Maryland, Indiana, Nebraska and Washington and records from Virginia, District of Columbia, Pennsylvania, Iowa, Illinois, Ohio, Kansas, Idaho, Colorado, California and New Mexico. It has been reared from cocklebur seed (*Xanthium*).

***Euaresta angustipennis* Lw.**

= *Tephritis angustipennis* Lw.

My specimens are from Ottawa, Canada, Nova Scotia, New York and Washington and it has been taken in New Jersey and Alaska.

***Euaresta subpura* John. Fig. 55.**

I have specimens from Anglesea, New Jersey, but it is recorded from Wildwood, New Jersey, on Sea burweed (*Xanthium echinatum*).

***Euaresta pura* Lw. Fig. 56.**

Specimens from Massachusetts and New York.

***Euaresta webbii* Doane. Fig. 57.**

I have one specimen from Dr. A. L. Melander and reports of its capture in Minnesota and Idaho.

Genus **TRYPANEA** Schrank. 1796.

(= *Urellia* Lw.)

Genotype, *Trypanea stellata*.

These are dark gray flies, more or less densely covered with white pollen, whose bodies are quite slender as compared with the species of *Euaresta*. The abdomen is generally longer than the thorax, and

usually not as wide. The wings are hyaline with a black star-shaped pattern on the apex. Occasionally the hyaline of the wing has a shadowy reticulation. The scutellum has either two or four bristles. Vein  $R_{4+5}$  is sometimes bristly, and the cross-veins are approximate and perpendicular, while the  $m$  cross-vein is slightly curved.

#### KEY TO THE SPECIES.

A. Wing without a pale shadowy reticulation besides the dark stellar spot. The scutellum has two long bristles.

B. The black spot has eight rays, seven of which reach the margin of the wing. Two hyaline spots are present in the black spot, one at the tip of vein  $R_{2+3}$  and the other in cell  $R_5$ , touching vein  $M_{1+2}$  and situated between the cross-veins. The female is 3 mm. long.

*daphne* Wied.

BB. The dark star has nine rays, eight of which reach the margin. There are two hyaline spots in approximately the same positions as in the preceding. Female 4.5 mm. .... *dacetopectera* new species.

AA. The wing has a pale reticulation over the whole, and with a black stellar spot on the apical half. The scutellum has four bristles.

*abstersa* Lw.

*Trypanea daphne* Wied. Fig. 58.

= *Trypanea mevarna* Walk.

= *Trypanea solaris* Loew.

I have specimens from Nebraska and California but reports of its capture in Massachusetts, Rhode Island and Georgia.

*Trypanea abstersa* Lw. Fig. 60.

This collection contains representatives from New York, Oregon and Nebraska. It is reported from Cuba, New Mexico, South Dakota, Iowa, Minnesota and Massachusetts.

*Trypanea dacetopectera* new species. Fig. 59.

A dark pollinose species, with yellow legs and the whole body thickly covered with white hair. Front comparatively broad, one and one half times as wide as one eye, bristles brown. Scutellum gray pollinose with two long yellowish-brown bristles. Abdomen longer than thorax. Ovipositor shining black, flattened, about as long as last two abdominal segments. Wings hyaline with a large stellate spot on the apical half which sends off nine rays of approximately the same width, eight of which reach the margin. The first reaches the margin through the stigma; a second extends to the anterior margin a little beyond the stigma; a third and fourth at the tips of veins  $R_{4+5}$  and  $M_{1+2}$  respectively; the fifth and sixth through cell  $2dM_2$ ; the seventh covers the  $m$  cross-vein and the eighth runs more or less parallel to

the seventh, touching the margin in cell  $Cu_1$ . The ninth arises in the vicinity of the  $r-m$  cross-vein and extends half way across the discal cell. There is a light streak in cell  $R_5$  which margins the  $r-m$  cross-vein. Besides this, the dark spot encloses two hyaline drops, one at the tip of  $R_{2+3}$  and the other in cell  $R_5$ , touching vein  $M_{1+2}$  and situated between the two cross-veins. Vein  $R_{4+5}$  is bare. Female is 4.5 mm., male 4 mm. long. One female was taken June 6, 1916, at Karner, New York, by W. T. M. Forbes and the two males are from Rock City, New York, June 10, 1915. Type in Cornell University collection.

Genus **ENSINA** Lw. 1830.

Genotype, *Ensina sonchii* Linn.

The proboscis is geniculated, as long as the head, and with flaps that are much produced, reaching backwards as far as the mentum. The oral edge is strongly produced and there is no stellate edge to the reticulation of the wings.

**Ensina picciola** Bigot. Fig. 61.

(= *Ensina humilis* Lw.)

This is a small gray pollinose species, the female only 2 mm. long. The long geniculated proboscis is its remarkable feature. The scutellum bears two exceedingly long black bristles. The abdomen has two rows of black spots on the dorsum and the hyaline wings have a coarse and diffuse reticulation. The stigma is wholly black. One of my specimens has an extra spur in the middle of the  $m$  cross-vein. The material is all from Florida, though I have reports of its being taken in Bermuda, Jamaica, Cuba, Tennessee, Mississippi, Kansas, Illinois, Iowa, South Dakota and Colorado.

Genus **EURIBIA** Hendel. 1912.

(= *Tephritis* Lw.)

Genotype, *Euribia arnica* Linn.

Although the species of this genus always have reticulate wings, this reticulation is never stellate. The oral opening is projecting and the proboscis is short-geniculate. The yellow scutellum bears four bristles.

#### KEY TO THE SPECIES.

- A. The reticulation of the wing is made up, partly of yellow and partly of black, the latter being more or less confined to the stigma (a spot at the end of the subcostal vein and another at the end of vein  $R_1$ ) and in the region of the apex of vein  $R_{2+3}$ . The body is yellow, somewhat gray pollinose and with a yellow ovipositor. Vein  $R_{4+5}$  is bristly.

*fucata* Fabr.

AA. The reticulation of the wing is dark brown and black and without any yellow.

B. Vein  $R_{4+5}$  is bristly. This is a gray insect with pale yellow scutellum. The wings are large and mostly dark brown with minute hyaline spots. The base of the wing is hyaline and there is a conspicuous hyaline triangle beyond the stigma. . . . . *geminata* Lw.

BB. Vein  $R_{4+5}$  is not bristly.

C. The apex of the wing has few spots but has a round marginal one in cell  $R_5$ , two in cell  $R_3$  and three in second  $M_2$ . The reticulation leaves the extreme base hyaline but covers the rest of the wing with many round hyaline spots of various sizes. The black stigma has a hyaline spot. The face is white or pale yellow. . . . . *albiceps* Lw.

CC. No row of marginal spots around the apex as in the preceding. The body is gray with yellow feet. The wings have a coarse and diffuse reticulation. There is a row of black spots across the wing in the region of the base of cell  $R_3$  which forms an indistinct and interrupted band. Otherwise, the wing is practically clear hyaline up to the region of the stigma and *r-m* cross-vein. . . . . *clathrata* Lw.

*Euribia fucata* Fabr. Fig. 65.

= *Tephritis picturata* Snow.

I have specimens from New Jersey and Jamaica and it is also recorded from Florida.

*Euribia geminata* Lw. Fig. 62.

Messrs. E. T. Cresson and C. W. Johnson loaned me material taken in New Jersey and Pennsylvania.

*Euribia albiceps* Lw. Fig. 63.

After examining seventy-five specimens, I can find no character upon which Loew could establish a good species, *euryptera*. The shape and width of the wing varies greatly and so does the size and proximity of the six hyaline spots which make up the pyramid beyond the stigma. There is also great variation in the number of small spots in the region of the stigma and the pyramid. There seems to be no constancy, however, in the relationships of these variations with each other, so that for as many times as one could pick out a specimen of *euryptera* (with broad wings, small hyaline spots making up the pyramid with considerable space between, and with spots less numerous in the vicinity of the stigma), one could pick out specimens of half a

dozen other species. The wing I have figured would more nearly represent Loew's *euryptera* and shows something of the variation from his *albiceps*. My specimens were collected in New York and Nova Scotia, but the species has been reported from Maine and New Jersey. *T. euryptera* Lw. was described from a single specimen taken at West Point, New York.

*Euribia clathrata* Lw. Fig. 64.

The collection contains an excellent series from Washington and Utah. It is recorded from the Middle States and New Jersey.

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## EXPLANATION OF PLATES XVIII, XIX.

## PLATE XVIII.

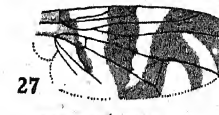
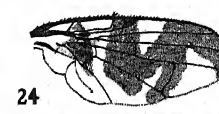
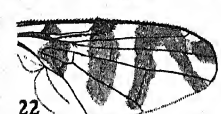
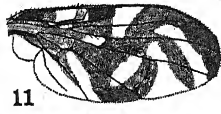
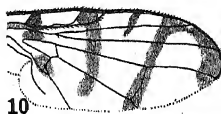
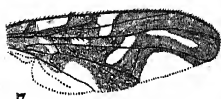
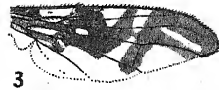
- FIG. 1. *Alcomylia alpha* n. sp.
- FIG. 2. *Straussia longipennis* Wied. var. *perfecta* Lw.
- FIG. 3. *Straussia longipennis* Wied. var. *typica* Lw.
- FIG. 4. *Straussia longipennis* Wied. var. *longitudinalis* Lw.
- FIG. 5. *Straussia longipennis* Wied. var. *vittigera* Lw.
- FIG. 6. *Straussia longipennis* Wied. var. *intermedia* Lw.
- FIG. 7. *Straussia longipennis* Wied. var. *arculata* Lw.
- FIG. 8. *Zonosema electa* Say.
- FIG. 9. *Zonosema flavonotata* Macq.
- FIG. 10. *Zonosema setosa* Doane.
- FIG. 11. *Acidia fratriq* Lw.
- FIG. 12. *Acidia sigma* n. sp.
- FIG. 13. *Phorellia tortilis* Coq.
- FIG. 14. *Peronyma sarcinata* Lw.
- FIG. 15. *Aciura (Eucosmoptera) nigricornis* Doane.
- FIG. 16. *Aciura (Eucosmoptera) tetraspina* n. sp.
- FIG. 17. *Aciura (Eucosmoptera) limata* Coq.



- FIG. 18. *Tomoplagia obliqua* Say.  
FIG. 19. *Rhagoletis juniperinus* Marc.  
FIG. 20. *Stenopa vulnerata* Lw.  
FIG. 21. *Rhagoletis tabellaria* Fitch.  
FIG. 22. *Rhagoletis cingulata* Lw.  
FIG. 23. *Epochra canadensis* Lw.  
FIG. 24. *Rhagoletis suavis* Lw.  
FIG. 25. *Rhagoletis pomonella* Walsh.  
FIG. 26. *Rhagoletis fausta* O. S.  
FIG. 27. *Rhagoletis striatella* v. d. W. (after van der Wulp).  
FIG. 28. *Procecidochares polita* Lw.  
FIG. 29. *Procecidochares penelope* O. S.  
FIG. 30. *Procecidochares setigera* Coq.  
FIG. 31. *Procecidochares atra* Lw.  
FIG. 32. *Terellia palposa* Lw.  
FIG. 33. *Terellia vernonia* Lw.

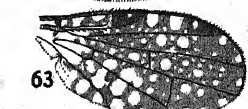
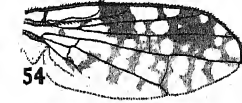
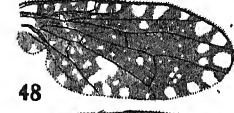
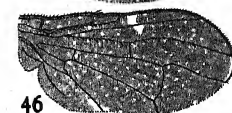
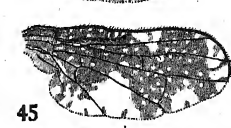
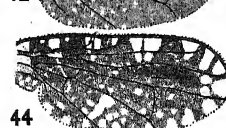
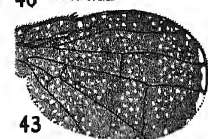
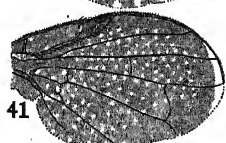
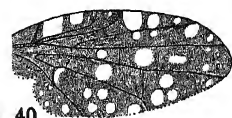
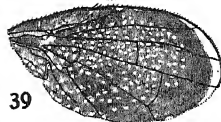
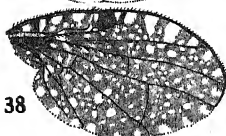
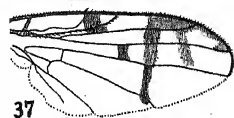
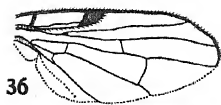
## PLATE XIX.

- FIG. 34. *Terellia floescentiae* Linn.  
FIG. 35. *Neaspilota alba* Lw.  
FIG. 36. *Neaspilota albidipennis* Lw.  
FIG. 37. *Neaspilota achillia* John.  
FIG. 38. *Xanthomyia platyptera* Lw.  
FIG. 39. *Eutreta sparsa* Wied.  
FIG. 40. *Acidogona melanura* Lw.  
FIG. 41. *Eutreta diana* O. S.  
FIG. 42. *Paracantha culta* Wied.  
FIG. 43. *Eutreta rotundipennis* Lw.  
FIG. 44. *Eurosta latifrons* Lw.  
FIG. 45. *Eurosta solidaginis* Fitch.  
FIG. 46. *Eurosta elsa* Daecke.  
FIG. 47. *Eurosta comma* Wied.  
FIG. 48. *Eurosta reticulata* Snow.  
FIG. 49. *Icterica seriata* Lw.  
FIG. 50. *Icterica circinata* Lw.  
FIG. 51. *Euaresta festiva* Lw.  
FIG. 52. *Euaresta bella* Lw.  
FIG. 53. *Euaresta aequalis* Lw.  
FIG. 54. *Euaresta angustipennis* Lw.  
FIG. 55. *Euaresta subpura* John.  
FIG. 56. *Euaresta pura* Lw.  
FIG. 57. *Euaresta webbii* Doane.  
FIG. 58. *Trypanea daphne* Wied.  
FIG. 59. *Trypanea dacetoptera* n. sp.  
FIG. 60. *Trypanea abstersa* Lw.



TRYPETIDAE





TRYPETIDAE



- FIG. 61. *Ensina picciola* Bigot.  
FIG. 62. *Euribia geminata* Lw.  
FIG. 63. *Euribia albiceps* Lw.  
FIG. 64. *Euribia clathrata* Lw.  
FIG. 65. *Euribia fucata* Fabr.  
FIG. 66. *Zonosema electa* Say, n. var.
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## A NEW SPECIES OF POLYDRUSUS GERMAR (COLEOP.).

BY LEWIS B. WOODRUFF,

NEW YORK, N. Y.

While on visits to south-central Alabama early in 1921 and 1923 specimens of an Otorhynchid beetle unknown to me were taken by beating maples. Recently upon attempting to identify them as our eastern *Polydrusus americanus* Gyll., it became apparent that they were structurally very different from that species, as well as smaller and much paler. That led to a careful consideration not only of those species described from our southwestern territory, Lower California, Mexico and Central America, but of European species as well, in the latter case especially because several adventitious species of this and allied genera have already made their appearance here—most likely introduced in nursery stock. The net result is my conviction that the species in question is indigenous and undescribed, and its description follows:

### *Polydrusus decoratus* new species.

Oblong oval, compact. Inner wings present, fully developed. Brown to piceous, alutaceous, shining, legs, antennæ and mouth parts somewhat lighter; abdominal segments black. Surface above completely covered by close-set grayish-white, ashy and light brown scales which are squarish or broadly ovate or rounded, the light brown ones on elytra condensed on the disk to form a three lobed patch with a short, broad stem toward but not reaching base. This patch in some specimens is outlined with darker brown scales. There is also a small brown spot at the apical end of the fourth stria. On the thorax these light brown scales form a median and, at base, two lateral longitudinal lines approaching but not reaching apex, in some specimens fusing together over the whole dorsal surface; and on the head they likewise form a median and, back of the eyes, two lateral lines reaching the base, in some specimens confluent across base. Surface below densely covered with whitish spatulate scales, distinctly separated along

gular suture, less densely placed on abdominal segments and legs, those on femora beneath, and on tibiae predominantly, with an intermingling of ligulate scales; those on last ventral segment hair-like. Antennae glabrous, rather sparsely and very coarsely hairy, densely so and more finely on elongate oval club; hairs of scape broad and scale-like; scape reaching front margin of thorax, slender, moderately clavate. Joints of funicle obconic, first at least twice as broad and three times as long as second, and much longer than second and third together; second joint twice as long as wide; third as wide as long, hardly more than half as long and much less robust than fourth. Scrobe deep, bending above at a rounded right angle, reaching bottom of beak at so obtuse an angle as to be almost perpendicular to it, but not extending or converging beneath it. Beak short, flat, broadly notched at tip, nasal plate very small; beak but little constricted before eyes, about two thirds length of head, rather thickly clothed with long, erect, bristling, very dark brown and conspicuously broad setae, broadest at their apex, protruding through its scaly covering, and continued, more sparsely, over head. Eyes moderate, broadly rounded in front, slightly pointed above and below, between these points the arc of the rear margin greatly flattened. Thorax constricted at apical fourth and distinctly wider than long, shorter than head and beak, sides rounded, not globosely, base truncate with narrow margin. Dark brown setae like those on beak and head, numerous over dorsal surface, somewhat inclined forward. Scutellum distinct, roughly quadrate, about as broad as long, raised above adjoining elytral surfaces by its ashy scaly covering, and bordered with light brown scales which reach it along suture. Elytra much wider than thorax, ventricose, broadest two fifths from apex, their humeri prominent, each with ten deep striae coarsely and closely impressed with subquadrate punctures, third and fourth striae slightly sinuate on basal fifth; intervals broad, slightly convex, their convexity obscured by scales, each with a single row of fine, widely spaced punctures along middle bearing dark brown bristling setae as described above, these setae somewhat inclined rearward and as long or longer than one half the width of such intervals. Beneath, second ventral at middle almost four times as long as third; first strongly sinuate apically, third slightly so basally. Legs moderate in length, femora strongly clavate, unarmed, the anterior pair a little shorter and stouter than the others. Tibiae outwardly with a row of widely spaced, blunt spines curving forward, apex strongly mucronate, front and middle pairs bent inward apically. Claws connate at base. Length from front of eyes: 3.10-3.75 mm.; width at humeri: 1.25-1.40 mm.

Holotype ♀, Hazen, Alabama; April 4, 1921. Allotype ♂, same locality and date. Sixty specimens taken by me on *Acer saccharinum* and on neighboring *Quercus prinus*. Type in my collection. Paratypes in collections of American Museum of Natural History, United States National Museum, Mr. Charles W. Leng, and Mr. Howard Notman.

From *P. americanus* Gyll. this new species is distinguished by the much paler brown scales of the dorsal patch, which in the former extend along the third and thence by the fourth interval to the base,—

by the spatulate or rounded scales on third and fourth ventral segments, and on scape by ligulate instead of hairy ones; by the lack of the border of white scales about the scutellum which characterizes *americanus*, by the shorter and much less constricted beak, much more perpendicular antennal scrobe, which in *americanus* makes an acute angle with bottom of beak and does not quite reach it,—and in the relative lengths of the first four funicular joints. While the ornamentation of its elytra suggests *americanus*, it seems much more nearly related to *P. peninsularis* Horn, in size, general pale color and form, and especially in the character of the antennal scrobe. It is however at once distinguished by the length of the scape, which in that species, although exceeding the rear of the eyes, does not reach the rear of the head; by the relative lengths of the funicular joints, which in *peninsularis* compare with each other as follows: First about twice length of second, but little longer than second and third together; third cylindrical, a very little longer than wide, and a little shorter than fourth; and by the following diverse characters of the latter, to-wit: Beak about half length of head instead of two thirds as in this new species; thorax about as long as wide instead of shorter, scales of femora ligulate to hairy, not rounded; few dark scales on head, not arranged in rows; the darker scales on elytra in great minority, more or less irregularly placed and not forming a conspicuous dorsal patch; and by the very short and pale erect setæ of head, thorax and elytra as compared with the long, broad and dark ones characterizing *decoratus*. *Ochreus* (Fall), known from New Mexico, is a yellowish species as its name implies, with a pale green sheen, with which *decoratus* could hardly be confused, the latter entirely lacking the green tint and lustrous effulgence so common in the genus.

This species was found to be fairly abundant on sugar maple at the type locality, and I have no doubt that its host plant there was that tree. If so, it would seem that it should be found further north where that tree prevails.



PROCEEDINGS OF THE NEW YORK  
ENTOMOLOGICAL SOCIETY.

MEETING OF DECEMBER 5.

A regular meeting of the New York Entomological Society was held at 8 P.M., on December 5, 1922, in the American Museum of Natural History, Vice-President Harry B. Weiss in the chair, with 20 members and seven visitors present.

The librarian reported accessions.

Mr. Davis announced semi-centennial meeting of Brooklyn Entomological Society on December 14 and invited the members of the New York Entomological Society to be present.

Mr. Mutchler exhibited "New Species of West Indian 'Lampyridæ,'" principally from Sierra Maestra of Cuba, and its culminating Pico Turquino, 7,900 feet in height. Many had been collected by Mr. S. C. Bruner, of the Experimental Station at Santiago de las Vegas. Fifteen species were included and with the 35 previously described, made an addition of about 40 per cent. to the described species.

Mr. Weiss spoke on "Gypsy Moth Work in New Jersey," the third year of which is now in progress. The success of this work covering 1,200 square miles, scouting for egg masses and creosoting them when found, besides spraying and banding the trees, has been phenomenal. The 30,003,039 egg masses found the first year was reduced to 909 the second year and still further reduction will reward the third year's work. The cost has been about \$250,000 annually, about 200 men being employed, besides 21 spraying machines, costing \$6,500 each; but if the work can be continued for a few more years, the pest will be exterminated at less cost than in Massachusetts.

Dr. Bequaert gave "A Comprehensive Account of Diptera whose Larvæ Parasitize Vertebrates" in which these Diptera were first shown to belong to several natural groups, then classified according to the nature of their parasitism, and according to their relationship. Five boxes were used to show the adults and many vials to show the larvæ. In this way the parasites of the horse, rhinoceros, elephant, camel, sheep, antelopes, reindeer, cattle, rabbits and man were shown, down or up to one from DeWitt Miller's skin. Finally the distribution was considered, showing Africa, with its numerous large mammals, to be the most favored region at present, and the fossil remains to be scanty.

The discussion by Messrs. Davis, Weiss, Engelhardt and Dr. Sturtevant brought out many additional facts.

Mr. Dickerson read part of a letter from Jan Obenberger, questioning the reference of our species of *Rhabdoscelis*, which may be more correctly placed in *Paragrilus*.

Mr. Engelhardt spoke of the possibility of *Albuna pyramidalis* occurring in the Evening Primrose.

Mr. Davis exhibited a living *Endrotes ventricosus*.

Mr. Schott exhibited a European ladybug, *Bulea lichatschovi* Hummel, found at Rutherford, N. J., November 10, 1922, eating the scale *Chionaspis evonymi*.

#### MEETING OF DECEMBER 19.

A regular meeting of the New York Entomological Society was held at 8 P.M., on December 19, 1922, in the American Museum of Natural History, vice-president Harry B. Weiss in the chair, with 15 members and seven visitors present.

The following new members were elected: on nomination at previous meeting by Mr. Watson,

Cecil D. Wright, 73 West 92d St.,

Arthur J. Fenton, 73 West 92d St.,

and on nomination by Mr. Watson,

F. Martin Brown, 2665 Briggs Ave.,

and on nomination by Mr. Barber,

Ferdinand A. Varrelman, American Museum of Natural History, the by-laws having been suspended to permit of the last two being included in the Academy Directory for 1923.

Mr. Woodruff spoke of the desirability of commencing meetings at 8 P.M., and closing at 10 P.M., to avoid unnecessary expense and labor for the Museum.

The chairman appointed as a Nominating Committee, Messrs. Notman, Dickerson and Watson.

On motion by the Treasurer, Mr. J. W. Smith was dropped for non-payment of dues.

Mr. Notman spoke on "Notes on the tribe Osoriini," using a collection from various parts of the world and blackboard drawings as illustration. He explained in detail the parts used in the classification, number of tarsal joints, form of head, relative position of eye and antenna, pilosity of labrum, etc. He commented on the antennæ being in some species geniculate, in others not; on the last joint of palpi being subulate in one genus, the eyes lacking in two more, the scutellum lacking in another, and still other great structural differences being observable in one tribe, some of which indicated a transition to the tribe Oxytelini.

Mr. Sherman having taken the chair and called for general notes, Mr. Davis exhibited some large plant lice.

Mr. Alfred Emerson, present as a visitor, spoke of Syrphid flies attacking such plant lice.

Mr. Weiss exhibited the remains of a roach embedded in the paper on which one of his separates was printed. Mr. Appell, on invitation from the chair, expressed his pleasure at being present and recalled the time when, as a boy of 15, he first guided Mr. Davis about the woods near Washington.

Mr. Emerson spoke briefly on his Termite studies.

Messrs. Weiss, Davis and Sherman expressed disapproval of the circulars mailed from Portland, Oregon, reflecting upon Dr. Howard.

Dr. Bequaert announced the election of Mr. Charles W. Leng, as Honorary President of Brooklyn Entomological Society, at its semi-centennial celebration on Dec. 14, Mr. Leng being the survivor of the six incorporators of that Society in 1885.

#### MEETING OF JANUARY 2.

The annual meeting of the New York Entomological Society was held at 8 P.M., on January 2, 1923, in the American Museum of Natural History, President John D. Sherman, Jr., in the chair, with 19 members and six visitors present.

Mr. Notman, for the committee, nominated the following officers for the year 1923:

*President*—Harry B. Weiss.  
*Vice-President*—Frank E. Lutz.  
*Secretary*—Charles W. Leng.  
*Treasurer*—William T. Davis.  
*Librarian*—Frank E. Watson.

#### *Executive Committee.*

H. G. Barber,	Joseph Bequaert,
G. P. Engelhardt,	G. C. Hall,
L. B. Woodruff.	

#### *Publication Committee.*

John D. Sherman, Jr.,  
E. L. Dickerson,  
Howard Notman,  
C. E. Olsen.

There being no other nominations, the secretary, on motion duly made and seconded, cast one affirmative ballot, thereby electing these nominees.

Mr. Weiss took the chair and briefly thanked the Society for the honor conferred upon him. Mr. Woodruff proposed as active members:

Mr. Walter Everts, 245 West 69th St.  
Dr. Charles A. Leale, 500 Madison Ave.

Mr. Alfred Emerson, of the University of Pittsburgh, made an interesting address, illustrated by lantern slides, on "Ecological Relations of Termites," based on observations at Kartabo. He pointed out first the conditions found in the nests, viz.: comparative permanence, constant high temperature, plentiful supply of refuse, eggs, etc., the nest material itself organic, all necessarily with protection from enemies. The nests he classified as either subterranean, arboreal or pendulous. He then passed to Wassmann's classification of the inhabitants into four categories. 1°. Those living in the

galleries, not with the termites, the bees *Englosa* and *Trigona* and eggs of lizards for example. 2°. Those living in the galleries with termites, synechtrans or persecuted intruders, of which he instanced a curious snake and certain Pselaphid beetles, and synoeketes, or ignored intruders, including many Histerid and Aleocharid beetles. 3°. True Symphiles, taken care of by the termites, and often physogastric in form; many of these were shown and many remarkable features described, the enlarged pronotum, the permanently recurved abdomen, and the abdominal appendages, especially developed in the beetle *Spirachtha mirabilis* Schiodte. 4°. True ecto- or ento-parasites including flies near to Phorids, Braconid wasps, and fungus.

Many interesting facts are omitted in the brief summary of Mr. Emerson's remarks.

In the discussion that followed Dr. Lutz referred to the abdominal appendages discovered by Mr. Mutchler, in the Lycid beetle *Thonalmus* from Montserrat, and Messrs. Notman, Davis, Olsen, Engelhardt, Weiss and Woodruff also contributed facts.

Dr. Bequaert discussed at some length the comparison between South American termite guests as described by Mr. Emerson, and those he had observed in Africa.

Prof. James S. Hine, of Columbus, present as a guest, spoke briefly of his work in Tabanidæ, especially of the unnecessary number of genera.

Mr. Angell exhibited some unusual forms of *Cicindela repanda*.

Mr. Schott exhibited a second specimen of the European Coccinellid *Bulæa lichatschovi* Hummel found at West Orange, N. J., December 19.



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### SAW-FLIES OF THE KATMAI EXPEDITION TO ALASKA.<sup>1</sup>

BY ALEX. D. MACGILLIVRAY,

URBANA, ILL.

The saw-flies collected by Professor James S. Hine, a member of the Katmai Expedition of the National Geographical Society, were submitted to me for identification and description. The number of species included in the collection made by Professor Hine as well as in that of Professor Trevor Kincaid of the Harriman Alaska Expedition is remarkably small.

#### *Emphytus gemitus* new species.

Female. Body black with the labrum, tegulae, middle of basal plates, and the tergum and sternum of the fourth abdominal segment, white; legs beyond the apices of the coxae rufous; clypeus deeply roundly emarginate; supraclypeal area elevated; ocellar basin broad and shallow, median fovea pit-like; vertical furrows distinct; ocellar and interocellar furrows not prominent; ocellar furrow not connected with the interocellar basin; antennae with the first segment of the flagellum slightly longer than either of the subequal second and third segments; saw-guides with the margins converging, the ventral margin convex, broadly convexly rounded to a point above at apex; wings hyaline, the veins and stigma brownish. Length, 8 mm.

*Habitat*: Kodiak, Alaska; Jas. S. Hine, collector.

This species is near *mellipes* Norton, the form of the head will separate them.

#### *Dolerus nyctelius* new species.

Male. Body black with the knees, the tibiae, the tarsi more or less, and abdominal segments one to three, rufous; the antennae with the first and second

<sup>1</sup> Contributions from the Entomological Laboratories of the University of Illinois. No. 80.

segments of the flagellum subequal, the second longer than the third; the front, frontal orbits, and the postocellar area closely finely punctate; the vertical orbits convex, sparsely punctate; with a more or less distinct transverse furrow; the median lobe of the mesonotum uniformly punctate; the lateral lobes of the mesonotum sparsely punctate and with an impunctate area extending to median lobes; the mesoscutellum coarsely closely punctate; the appendages of the scutellum smooth; the wings hyaline, the veins and the stigma black. Length, 6 mm.

*Habitat*: Kodiak, Alaska; Jas. S. Hine, collector.

This species runs to *icterus* MacG.

***Dolerus nivatus* new species.**

Female. Body black with abdominal segments one to four and a part of five, rufous; the antennæ with the first segment of the flagellum longer than the second, the second and third subequal; the front and frontal orbits finely closely punctate; the postocellar area finely densely punctate, more coarsely than the front and finer than the vertical orbits; the vertical furrow distinct, long, linear; the ventral end of each antennal furrow almost obsolete; the median lobe of the mesonotum finely punctate, more closely but not more coarsely than the lateral lobes, punctures uniform in size; the median lobes of the mesonotum with an impunctate area; the mesoscutellum densely punctate; the appendage of the scutellum large, striations not prominent; the mesopleura coarsely punctate, the pectus densely finely punctate; the saw-guides retracted, the dorsal and ventral margins convergent, the distal portion bluntly pointed; the wings hyaline, the veins and the stigma black. Length, 12 mm.

*Habitat*: Katmai, Alaska; Jas. S. Hine, collector.

This species runs to *unicolor* Beauv.

***Dolerus nemorosus* new species.**

Female. Body black with the abdominal segments one to three, the protibiæ and mesotibiæ, and the protarsi, rufous; the head and thorax with short white setæ; the antennæ with the first segment of the antennæ longer than the second, the second slightly longer than the third; the front, the frontal orbits, the vertical orbits, and the postocellar area uniformly punctate; the head not with a transverse furrow extending from the vertical orbits behind the compound eyes; the vertical furrows punctiform; the median lobe of the mesonotum finely punctate, not with a row of large punctures on each side; the lateral lobes of the mesonotum and mesoscutellum finely punctate; the mesopleura coarsely punctate; the saw-guides with the dorsal and ventral margins straight, parallel, the distal portion oblique, long, convex, bluntly pointed above; the wings hyaline, the veins and the stigma black. Length, 7.5 mm.

This species is related to the *nudus* group of species.

*Habitat*: Katmai, Alaska; Jas. S. Hine, collector.

***Dolerus negotiosus* new species.**

Male. Body black with abdominal segments two and three and a part of the fourth, the knees, and the greater part of the prothoracic tibiæ, rufous;

antennæ with the third and fourth segments subequal, the fourth slightly longer than the fifth; front and facial orbits uniformly densely punctate, postocellar area coarsely punctate, vertical furrows elongate pit-like depressions, about twice as long as wide; an impunctate area on each vertical orbit, extending to vertical furrow; median lobe of mesonotum coarsely punctate, each lateral portion more densely punctate than the mesal; lateral lobes of mesonotum densely punctate, not with an impunctate area; mesopleura densely punctate; wings hyaline with the veins, stigma, and costa blackish. Length, 7 mm.

*Habitat*: Savonoski, Katmai, and Kodiak, Alaska; Jas. S. Hine, collector.

This species is related to *knovei*, *nemorosus*, and *numerosus*.

***Dolerus elderi* Kincaid.**

Valdez, Alaska. July 1919.

***Rhogogastera respectus* new species.**

Female. Body green with a black spot on the vertex, surrounding ocelli, except edges of frontal furrow, the mesonotum except two marks on the median lobe and one each on each lateral lobe of the mesonotum, the mesoscutellum, the dorsal aspect of the abdomen, except a narrow band at each lateral margin, a black line on the femora, tibiæ, and the apices of the tarsal segments; clypeus roundly emarginate; antennæ with the second segment of the flagellum larger than the third, the two together subequal in length to the first; frontal furrow not deep, interrupted; head polished, impunctate; saw-guides straight above, slightly convex below, convexly rounded at apex; wings hyaline, veins black, stigma and costa black. Length, 11 mm.

*Habitat*: Katmai, Alaska; Jas. S. Hine, collector.

***Rhogogastera respersus* new species.**

Male. Body green with the upper side of the antennæ, the antennal furrows in part, the interocellar furrow, an irregular line extending around the ventral side of the green elevation bearing the median ocellus, a small spot on each side of the clypeus, narrow lines on the sutures of the notum and plura, and narrow lines on the caudal margin of the cephalic abdominal terga, and a line on the femora and tibiæ, black; antennæ with the second and third segments of the flagellum subequal and together longer than the first segment; clypeus shallowly emarginate; frontal furrow short and deep, reaching only half way to the median ocellus; wings hyaline, veins brownish, stigma and costa white. Length, 10 mm.

*Habitat*: Katmai, Alaska; Jas. S. Hine, collector.

This species is similar to the preceding, from which it is readily separated by the difference in color and the structure of the frontal furrow.

***Tenthredo nigricollis* Kirby.**

Katmai, Alaska, July 1917.



***Tenthredo variegata* Norton.**

Katmai, Alaska, June 1917.

***Tenthredo scævola* Cresson.**

Katmai, July 1917, and Kodiak, Alaska, June 1917.

***Tenthredo rusticula* new species.**

Male. Body black with the labrum, the clypeus, sometimes with only a spot on each side, the mandibles, the genal orbits, a short spot on the mesopleura, the pectus, the extent of the pale spot variable, a spot above the posterior coxæ, and the sides of the basal plates, yellowish-white; the coxæ all broadly beneath, the front and middle legs beneath, the metafemora, and the metatibiæ, reddish-yellow, paler on the anterior legs; the abdomen with most of the tergum of the first segment, all of segments two to five, and a part of the sixth, rufous, the sterna all pale; antennæ with the first segments of the flagellum distinctly longer than the second but not as long as the second and third together; head polished, impunctate; the clypeus roundly emarginate; the front with a deep furrow; the thorax finely punctured. Length, 10 mm.

*Habitat*: Katmai and Kodiak, Alaska; Jas. S. Hine, collector.

This species is similar to *lacticincta* Cresson.

***Tenthredo retinentia* new species.**

Female. Body black with the labrum, clypeus, genal orbits, extending onto the frontal and occipital orbits, a minute dot at the meso-caudal angle of each compound eye, the angles of the pronotum, the tegulæ, the front legs, except a small portion of the proximal ends of the procoxæ, the median legs, except black on the mesocoxæ, and the hind legs beyond the metacoxæ, the legs tending toward rufous, yellowish-white; abdomen rufous beyond the third segment; head roughened but not distinctly punctured; front with a broad roughened depression; clypeus broadly emarginate; antennæ with the second segment of the flagellum longer than the third, the second and third together subequal in length to the first; the thorax finely punctured; the saw-guides bluntly rounded, the dorsal margin straight; wings hyaline, the stigma and the proximal portions of the veins pale. Length, 12 mm.

*Habitat*: Kodiak, Alaska; Jas. S. Hine, collector.

This species is similar to *montana* Provancher.

***Tenthredo regula* new species.**

Female. Body black with the labrum, clypeus, and mandibles yellowish-white; the legs beyond the trochanters rufous; antennæ short, the first segment of the flagellum longer than the second and nearly as long as the second and third together; the clypeus broadly roundly emarginate; head setiferous and finely punctured; the frontal furrow deep, extending to the median ocellus, irregular; the mesonotum and mesoscutellum finely punctured; saw-guides on

dorsal and ventral margins straight, bluntly rounded at apex; wings hyaline, the veins and the stigma black. Length, 12 mm.

*Habitat*: Katmai, Alaska; Jas. S. Hine, collector.

This species falls near *erythromera* Provancher.

***Tenthredo requieta* new species.**

Female. Body black with the mandibles inconspicuously yellow-white; legs beyond the trochanters rufous; antennæ short, the second and third segments of the flagellum subequal, together slightly longer than the first, the second two-thirds the length of the first; the clypeus squarely deeply emarginate; head setiferous, finely punctured; the frontal furrow deep, broadly concave, extending to the median ocellus; the mesonotum and mesoscutellum finely punctured; the saw-guides with the dorsal margin straight and the ventral margin convex, obliquely rounded at apex; wings hyaline, the veins including the costa black, the stigma and the anal veins pale. Length, 10 mm.

*Habitat*: Katmai, Alaska; Jas. S. Hine, collector.

This species is very similar to the preceding in general coloration.

***Tenthredo refuga* new species.**

Female. Body black with the labrum, clypeus, mandibles, genal orbits, extending onto the occipital orbits, minute spot at the meso-caudal angles of the compound eyes, sometimes very small, collar, tegulæ, a spot above the posterior coxæ, sides of the basal plates, and the legs beyond the coxæ beneath, inclined more or less to rufous on the posterior pair, yellowish-white; the black line on the femora slightly interrupted on the profemora, strongly on the mesofemora, and very broadly on the metafemora; antennæ short, second and third segments of the flagellum subequal, together subequal in length to the first; the clypeus squarely deeply emarginate; head polished with fine punctures; the frontal depression prominent, extending to median ocellus, sides large, declivous, straight; mesonotum and mesoscutellum punctured; the saw-guides with dorsal margin straight, the ventral margin straight, obliquely rounded at distal portion; wings hyaline, veins brown, stigma and costa paler. Length, 10 mm.

*Habitat*: Katmai, Alaska; Jas. S. Hine, collector.

This species falls near *atracosta* MacG.

***Tenthredo retroversa* new species.**

Male. Body black with the labrum, clypeus, mandibles, genal orbits, minute dot at meso-caudal angle of compound eyes, and spot above posterior coxæ, yellowish-white; legs pale, the profemora yellowish with a black line above on proximal half, extending onto lower surface, protibiæ and protarsi entirely yellowish, shaded with rufous, metafemora rufous beneath, black line above, interrupted near distal end, mesotibiæ and mesotarsi rufous, metafemora except a black line above on proximal one-fourth, and metatibiæ and metatarsi rufous; abdomen beyond the middle of the first segment rufous; antennæ with the flagellum indistinctly rufous, the first segment elongate, distinctly longer than the second,

the second and third subequal; the clypeus roundly emarginate; frontal furrow shallow, rounded; wings hyaline, veins brownish, stigma and costa pale. Length, 9 mm.

*Habitat*: Katmai, Alaska; Jas. S. Hine, collector.

This species is near *semirufus* MacG.

***Tenthredo reliquia* new species.**

Female. Body black with the labrum, clypeus, mandibles, genal orbits, extending broadly onto the occipital orbits, the collar, the tegulae, spot above the posterior coxae, and the sides of the basal plates, yellowish-white; the antennae, a spot on each frontal orbit, the occipital orbits, the vertical orbits, connected by a narrow band across the postocellar area, sometimes covering most of the frontal area, a V on the mesonotum, the mesoscutellum, the sides of the mesonotum, large spot on the mesopleura, the legs, the basal plates, and the abdomen beyond the third segment, including the saw-guides, rufous; abdominal segments one to three sometimes with a rufous spot on each side; antennae with the second and third segments of the flagellum subequal and together subequal to the first segment; clypeus angularly emarginate; saw-guides with the dorsal margin straight, the ventral margin slightly convex, bluntly rounded below at apex; wings hyaline, the veins including the costa, rufous, the stigma darker. Length, 11 mm.

*Habitat*: Katmai, Alaska; Jas. S. Hine, collector.

This species resembles *redimacula* MacG., closely.

***Tenthredo resticula* new species.**

Female. Body rufous with the labrum, clypeus, mandibles, genal orbits, collar, tegulae, edge of metapleura, spot above posterior coxae, and sides of basal plates, yellowish-white; the prothorax in great part, a small spot near the middle of each lateral lobe of the mesonotum, the pectus, sometimes at middle only, the sterna of abdominal segments one to three, black; dorsal portion of the antennae sometimes infuscated; antennae with the second and third segments of the flagellum subequal and together not quite as long as the first segment; clypeus roundly emarginate; saw-guides straight above, oblique below, and broadly convexly rounded at apex. Length, 11 mm.

*Habitat*: Katmai, Alaska; Jas. S. Hine, collector.

This species is very similar to *macgillivrayi* Smulyan.

***Trichiosoma aleutiana* Cresson.**

Katmai, Alaska. July 1917.

***Pontania dstricta* new species.**

Female. Body black with the labrum, clypeus, mandibles, genal orbits slightly, the collar, and the tegulae, white; the legs beyond the apices of the coxae resinous; the clypeus almost truncate; the supraclypeal area convex; the pentagonal area hardly defined, the frontal ridge wanting, the ocellar area flat, the median fovea slightly depressed and located between the antennae, ventral

end of ocellar area limited by a V-shaped elevation; vertical, ocellar, and interocellar furrows wanting; head and thorax finely sparsely roughened; saw-guides with the dorsal and the ventral margins convergent, the distal end oblique, concave, bluntly pointed above; cerci not as long as the saw-guides; wings hyaline, the veins and the stigma pale. Length, 4 mm.

*Habitat*: Katmai, Alaska; Jas. S. Hine, collector.

This species falls in tables near *cressoni* Marlatt.

***Pachynematus affinis* Marlatt.**

Katmai, Alaska. June 1917.

***Amauronematus veneficus* new species.**

Female. Body rufous with the fronto-clypeal suture, the ventral portions of the antennal furrows, widely expanded above the antennæ, an irregular area about the ocelli, the antennæ, a large spot on each lobe of the mesonotum, the caudal portion of the mesoscutellum, the metascutellum, an inverted V-shaped mark on the pectus, an elongated spot on the proximal part of the underside of the femora, the basal plates, abdominal terga one to six, the cephalic third of the seventh segment, and the margins of the saw-guides, black; the pentagonal area with rounded bounding ridges; the median fovea large, round; the frontal crest short, not broken; the vertical and interocellar furrows deep, linear; ocellar furrow wanting; antennæ with the first segment of the flagellum shorter than the second, the second and third segments subequal; the saw-guides with the dorsal margin oblique, the ventral margin convex, converging rapidly to a blunt point at apex; the wings yellow, the veins and the stigma pale. Length, 9 mm.

*Habitat*: Katmai, Alaska; Jas. S. Hine, collector.

The coloration of the body and the structure of the head will differentiate this species.

***Amauronematus ventosus* new species.**

Female. Body rufous or resinous with the supraclypeal area, the ventral portion of each antennal furrow, a spot about the ocelli, a spot on the postocellar area, the antennæ, a large spot on each lobe of the mesonotum, the mesoscutellum except two minute dots, the metanotum, the metascutellum, a broad line on each side of the pectus, the metapleura, the basal plates, and the abdomen, except the two caudal segments, black; the clypeus shallowly emarginate; the antennæ with the three proximal segments of the flagellum subequal; the supraclypeal area nearly flat; the pentagonal area not well defined, a distinct furrow extending from the median ocellus to the supraclypeal area, deeply dividing the frontal crest and with a minute median fovea at its ventral end; the saw-guides with the dorsal margin straight, the ventral margin convex, bluntly obliquely pointed above; the wings yellowish, the veins and the stigma pale. Length, 7 mm.

*Habitat*: Valdez, Alaska; Jas. S. Hine, collector.

This species is closely related to the preceding, the form of the frontal crest will separate them.

**Amauronematus veridicus** new species.

Female. Body rufous with the labrum, clypeus, mandibles, supraclypeal area, genal orbits, ventral half of frontal orbits, spot about ocelli, caudal aspect of head in part, two proximal segments of the antennæ, a spot on the median lobe of the mesonotum, the caudal portion of the mesoscutellum, the metascutellum, the sides of the pronotum, the lateral and ventral aspect of the mesothorax and metathorax, and the coxæ, black; the clypeus narrowly shallowly roundly emarginate; antennæ with the first segment of the flagellum shorter than the second; the pentagonal area not distinct, the frontal crest elevated, broken, median fovea linear; head and thorax setiferous; the saw-guides stout, with strongly equally convergent dorsal and ventral margins, the dorsal slightly concave, the ventral convex, bluntly pointed; the wings yellow, the veins and stigma resinous. Length, 7.5 mm.

*Habitat*: Katmai, Alaska; Jas. S. Hine, collector.

This species is near *isolatus* Kincaid.

**Pteronidea shumagensis** Kincaid.

Katmai, Alaska. June 1917.

**Pteronidea erratus** new species.

Female. Body rufous throughout, first and second pairs of legs shading more or less through whitish to resinous; clypeus broadly shallowly emarginate, the emargination distinctly broader than the lobes, the lobes rounded; pentagonal area prominent with strongly elevated bounding walls; frontal crest strong, unbroken; the median fovea a large circular depression; the median ocellus located on an elevation within the walls of the pentagonal area, the elevation with a circular depression on the ventral side of the median ocellus; the ocellar furrow indistinct, the interocellar furrow wanting; the postocellar area with a median depression; the antennæ with the first segment of the flagellum subequal or shorter than the second; the saw-guides retracted, the distal portion angularly pointed; the wings hyaline, inclined to brownish, the stigma and veins brownish. Length, 9 mm.

*Habitat*: Kodiak, Alaska; Jas. S. Hine, collector.

This species belongs near *unicolor* Dyar.

**Pteronidea excessus** new species.

Female. Body resinous with the basal plates, terga of segments one to six for the most part, and the margins of the saw-guides, black; the legs lighter in color than the remainder of the body; the clypeus roundly emarginate, the clypeal lobes large, angular; the pentagonal area distinct, not prominent; the frontal crest short, not strongly raised, not broken; the median fovea an elongate depression, more than twice as long as broad; antennæ with the first and second segments of the flagellum subequal; head and thorax polished; the saw-guides with the dorsal margin straight, converging just at end, the ventral margin long, obliquely rounded to a point at apex above; the wings hyaline, the veins and stigma pale. Length, 5 mm.

*Habitat*: Katmai, Alaska; Jas. S. Hine, collector.

This species differs from the preceding in coloration only in the black of the abdomen.

***Pteronidea effrenatus* new species.**

Female. Body rufous with indications of a spot about the ocelli, a spot on each of the lobes of the mesonotum, sometimes wanting, the metascutellum, the basal plates, and abdominal terga one to six, the width of the bars on the caudal segments varying from a small spot to one covering most of the segment, black; parts of the head and legs resinous or whitish; antennæ with the first segment of the flagellum not quite as long as the second; the clypeus narrowly shallowly roundly emarginate; the clypeal lobes as broad as the emargination, rounded; pentagonal area distinct, walls sharply elevated ridges; frontal crest short, distinct, unbroken; the median fovea a distinct depression, distinctly longer than broad; area enclosed by the walls of the pentagonal area flat, a small concavity on the ventral side of the median ocellus; the saw-guides stout, the dorsal margin straight, the ventral margin regularly convex, oblique on the distal portion to a blunt point above; the wings hyaline, the stigma and the veins pale. Length, 7 mm.

*Habitat*: Katmai, Alaska; Jas. S. Hine, collector.

This species is similar to the preceding, the coloration, the median fovea, or the saw-guides will serve to differentiate them.

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## BACKYARD COLLECTING IN RAMSEY, N. J.

BY CHRIS. E. OLSEN,

WEST NYACK, N. Y.

Being particularly interested in Cicadellidæ, it was my privilege to examine a boxful, including a few species of other families, collected by Dr. Frank E. Lutz over a period of several years. This collecting was restricted to his backyard at Ramsey, northern New Jersey, at an altitude of about 400 feet. A good deal of interesting material was found in this lot, much of which had not been reported from the State before, while others were listed only by single records and in many cases from quite the other end of New Jersey. It seems advisable to give the list in full with annotations to the more interesting species. Although some of these are quite common insects, nevertheless, their distribution within the state of New Jersey is apparently little known. Names in parenthesis are those used in Prof. John B. Smith's Catalogue of the Insects of New Jersey, 3d Edition, 1910.

1545a *Monecphora bicincta ignipecta* Fitch (1 specimen).

August 11, '17. This is reported now and then in the eastern states as far north as Pennsylvania, New Jersey, and Massachusetts.

1546 *Aphrophora quadrinotata* Say. (2 specimens).

August 3-11, '17.

1570 *Ceresa diceros* (Say.) (1 specimen).

August 7, '17.

1572 *Ceresa bubalus* (Fabricius) (3 specimens).

August, September, '17-'18.

1579 *Ceresa borealis* Fairmaire (3 specimens).

July 17-31, '17-'18.

1719 *Publilia concava* (Say.) (1 specimen).

August 11, '17.

1735 *Enchenopa binotata* (Say.) (1 specimen).

July 17, '18.

1765-1 *Agallia lingulata* (Olsen) M. S. (Bull. Bkl. Ent. So. XVII, p. 127, December, 1922) (1 specimen).

June 18, '18. Manuscript description of this species was in preparation when this specimen was examined. It materially assisted in corroborating the description, being the second female known to the writer and incidently extended its distribution into the state of New Jersey.

1767 *Agallia sanguinolenta* (Provancher).

1778 *Idiocerus pallidus* Fitch (1 specimen).

July 20, '17. A single previous record from Staten Island, N. Y. (This island has been included in the New Jersey list.)

1793 *Idiocerus scurra* (Germar) (3 specimens).

July 4-20, '17.

1802 *Idiocerus fitchi* Van Duzee (1 specimen).

*Idiocerus maculipennis* Fitch.

August 8, '18. This is the second record of this common leaf-hopper which is likely to be found in any part of the State; a former record is Jamesburg.

1821 *Macropsis (Pediopsis) trimaculata* (Fitch) (1 specimen).

June 29, '18. John B. Smith in "Insects of New Jersey," Second Edition, 1899, mentions this as being "Common in New York doubtlessly also in New Jersey" and again in Third Edition 1910, he notes "Sure to occur in New Jersey." There is no doubt that this insect is common in New Jersey and must have been collected often, but perhaps thought too common to be recorded. This seems to be the first authentic record.

1864 *Graphocephala (Diedrocephala) coccinea* (Forster) (5 specimens).

July-September, '17-'18.

1874 *Dræculacephala mollipes* (Say.) (17 specimens).

June-August, '14-'18.

1879 *Dræculacephala noveboracensis* (Fitch) (2 specimens).

July 23-26, '17-'18.

1897 *Gypona 8-lineata* (Say.) (17 specimens).

July-August, '14-'18.

1936 *Acucephalus albifrons* (Linnaeus) (5 specimens).

July 16-20, '18.

1940 *Xestocephalus pulicarius* Van Duzee (11 specimens).

July 26, '17. Previously mentioned as "probable in New Jersey."

1983 *Scaphoideus auronitens* Provancher.

1991 *Scaphoideus productus* Osborn (3 specimens).

July, August, '17-'18. First actual records, although reported from surrounding states.

1996 *Scaphoideus immistus* (Say.) (9 specimens).

July-August, '17-'18.

1997 *Scaphoideus melanotus* Osborn (1 specimen).

August 5, 1918. A good addition to the State List of New Jersey previously reported south and west of the state.

2023 *Platymetopius frontalis* Van Duzee (1 specimen).

Sept. 13, '18.

2063 *Deltocephalus inimicus* (Say.) (23 specimens).

June-August, '18.

2132 *Euscelis (Athysanus) striolus* (Fallen) (5 specimens).

June-August, '18.



- 2138 *Euscelis uhleri* (Ball) (1 specimen).

*Athysanus plutonius* Uhler.

June 29, '18.

- 2156 *Euscelis* (*Athysanus*) *curtisii* (Fitch) (2 specimens).

July–September, '17.

- 2181 *Eutettix strobi* (Fitch) (2 specimens).

July–September, '17.

- 2228 *Phlepsius irroratus* (Say.) (22 specimens).

June–September, '17–'20.

- 2246 *Phlepsius solidaginis* (Walker) (4 specimens).

*Phlepsius humidus* Van Duzee.

August 5–7, '17–'19.

- 2265 *Thamnotettix clitellarius* (Say.) (7 specimens).

June 20–27, '17.

- 2314 *Thamnotettix nigrifrons* (Forbes) (11 specimens).

*Thamnotettix perpunctata* Van Duzee.

June–September, '17–'18.

- 2326 *Chlorotettix spatulatus* Osborn and Ball (2 specimens).

August 5–21, '17–'18. A male taken in 1917 and a female in 1918. These are the first to be reported from New Jersey. Other localities are Tennessee and North Carolina.

- 2327 *Chlorotettix tergatus* (Fitch) (5 specimens).

July 31 to August 5, '17–'18.

- 2329 *Chlorotettix viridius* Van Duzee (3 specimens).

July 20, '17.

- 2331 *Chlorotettix galbanatus* Van Duzee (4 specimens).

July 16–20, '17. First authentic records.

- 2358 *Cicadula variata* (Fallen) (74 specimens).

Taken from June to August, 1917. None were taken in any other year. Upon examining the field notes it was found that they were all collected at light. This method of collecting had not been practiced at other times.

- 2393 *Dikraneura fieberi* (Loew) (3 specimens).

July 31, '17–'18.

*Dikraneura* sp. (3 specimens). July–August, '18.

2421 *Empoasca mali* (Le Baron) (9 specimens).

July–August, '17–'18.

2422 *Empoasca flavescens* (Fabricius) (1 specimen).

July 31, '17. First record for New Jersey of this widely distributed species. *Empoasca* sp. (1 specimen). July 31, '17 (perhaps same as preceding).

2430a *Empoa querci* var. *gillettei* Van Duzee.

*Empoa bifasciata* Gillette and Baker.

July 12–20, '17. Although there is hardly a trace of the crossbands in some of these specimens it is possible that all four belong to the above mentioned species.

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## THE LIFE HISTORY OF *THANAOS FUNERALIS* SCUD. & BURG. (LEPIDOPTERA; HESPERIIDÆ).

BY KARL R. COOLIDGE,

HOLLYWOOD, CALIF.

*Thanaos funeralis* is a common butterfly in Southern California, ranging eastward into Arizona, Texas and Colorado. In the vicinity of Los Angeles it is one of the earliest butterflies of Spring, appearing sometimes during the first week of February, but normally is not out in full force until the middle of March.

It is here triple brooded, the first brood waning about the middle of April and disappearing in early May. From the middle of May until late in June members of the second flight are emerging, and in late August and September those of the third appear. As with other species of *Thanaos* that are double or triple brooded, the first brood is by far the largest in point of numbers, the third brood especially being a scanty one. I have found but three food-plants:

### FABACEÆ.

*Hosackia glabra* Torrey. Deerweed. This is the usual food-plant, all three generations using it.

*Medicago sativa* Linn. Alfalfa. I have noted examples of the fall generation ovipositing on this plant.

## HYDROPHYLLACEÆ.

*Nemophila membranacca*. Snow Flakes. In Chino Canyon, on the Colorado Desert, members of the first brood were found ovipositing on the upper surfaces of the leaves.

The eggs are usually deposited on the under surfaces of the leaves, occasionally on the upper, and sometimes even on the stem. Though a swift and wary species, the females of *funeralis* when ovipositing become so intent upon their maternal performances that they are quite oblivious to any movement about them, and while examining a sprig of *Hosackia* I have had a female alight on it and deposit an egg even while I was endeavoring to capture her with my hand. In hatching the young larvæ eat out irregular jagged holes in the summits of the eggs, only devouring sufficient of the shell to make their escape. Following is a time record of the transitions:

Eggs laid April 13th.

Hatched April 22d.

Larvæ passed first moult April 27th.

Larvæ passed second moult May 4th.

Larvæ passed third moult May 9th.

Larvæ passed fourth moult May 14th.

Larvæ pupated May 19th.

Imagoes emerged June 14th.

The newly hatched larvæ are exceedingly active, scampering about anxiously until locating leaves that meet with their full approval. In the first instar the larvæ seem to attack only the surfaces of the leaves, both upper and lower.

In the later stages the usual type of *Thanaoid* nest is constructed, and the larvæ feed mainly—perhaps in Nature entirely, by night. Pupation occurs in the last larval nest.

Whether, as in Eastern species of *Thanaos*, the larvæ of the first brood destined to produce the generation of the following spring, hibernate in the last instar is a point I have not been able to settle, as all the larvæ I have procured pupated and emerged as the second brood. So too, whether the larvæ of the second and third broods hibernate is problematical.

Scudder (Butt. New Eng., Vol. 2, p. 1449, 1889) states of the larvæ of *Thanaos* that the apically expanded bristles of the earlier instars are replaced by short sharp hairs upon the assumption of the fourth

stage; but this does not hold true of *funeralis*, in which the fungiform hairs persist to pupation.

*The Egg*.—Subspherical, the base squarely docked, the sides narrowing upwards only slightly except towards the extreme summit, which is rather broadly rounded. A series of rather high, compressed longitudinal ribs, pellucid, ranging from base to, or nearly to, the micropyle depression in a slightly sinuous course. These ribs .12 mm. equidistant in the middle and .03 mm. in height. Between them a series of delicately raised cross ribs, .02 mm. apart, straight, and where they strike the main ribs they give to them a beaded appearance. The surface between the longitudinal ribs gently concave, minutely punctate. The longitudinal ribs varying in number, from twelve to sixteen. The micropyle in a flat slight depression, .14 mm. in diameter, consisting of a minute circular central cell bounded by large roundish-oval cells, and still larger oval-angular cells surrounding these. The minute central cell, .005 mm. in diameter; the surrounding roundish-oval cells, .01 mm. in length; the larger oval-angular cells, .018 mm. Surface of egg covered with a multitude of excessively fine roundish raised cells, quite uniform, .002 mm. in diameter. Color, when first laid, a very pale green, almost white. Changing in about forty hours to a distinct lemon yellow, and after forty-eight hours more to a conspicuous orange, with the longitudinal ribs remaining a saffron yellow; finally, just before hatching, to a deep brown. Height, .64 mm.; broadest in the middle of the lower half, .66 mm.; breadth at base, .56 mm.

*First Instar*.—Head and body uniform orange brown. Head, .44 mm. in diameter, orbicular, roughly granulated, and bearing some simple scattered tapering and apically expanding hairs, about .06 mm. in length; ocelli black. The dorsal shield of first thoracic segment small and obscure, a slight shade darker than the body. On the body there are four series of apically expanding bristles, as follows: An infrastigmatal series, one to a segment on the thoracic segments, placed in the middle; two to a segment on the abdominal segments, one placed before and one just after the middle of the segment. Those of the abdominal segments .04 mm. in length, and with the tips .02 mm. in diameter; those of the thoracic segments a little longer and less expanded at the tips. A suprastigmatal series, situated directly above

the spiracles, two each on the thoracic segments, placed close together, but only one on each of the abdominal segments. A lateral series, one each on all the segments, placed posteriorly. A supralateral series, one to a segment, placed anteriorly on the abdominal segments, but posteriorly on the thoracic, where they tend to become subdorsal. The bristles of these last three rows shorter than those of the infrastigmata, being only .02 mm. in height, with the expanded tips .025 mm. in diameter. Length, 1.6 mm.; width at first thoracic segment, .32 mm.; width at anal segment, .24 mm.

*Second Instar.*—Head now pitchy black, .70 mm. in diameter, roughly corrugated, but slightly bilobed. Head studded with numerous short-crooked clavate hairs, white, thickly but minutely spiculiferous, and but .03 mm. in height. Dorsal shield of first thoracic pale green, smooth, without hairs. The body studded with short white hairs of the same nature as those of the head, and of the same length. The segmental folds of each segment distinct. Color of body a uniform bright lemon yellow, but as the stage develops a more and more greenish coloration is assumed, until finally the lemon yellow is completely obscured by a green almost the exact color of the upper surfaces of the leaves of *Hosackia*. Ventral surface and prolegs concolorous with body above. Legs semi-opaque, very pale yellow. Length, immediately after first moult, 3. mm.; width at first thoracic segment, .60 mm.; width at anal segment, .42 mm.

*Third Instar.*—Head, 1.34 mm. in diameter, but slightly bilobed, corrugated, piceous black, thickly studded with irregular filament-like white hairs, .05 mm. in length on the average. Fore part of first thoracic segment smooth, pale yellow. Dorsal shield gray green. Body thickly covered with white hairs, tipped at the ends with saucers. These hairs but .03 mm. in height and of the same diameter at tips, and arranged in fairly regular transverse series. The tubercles from which these body hairs arise pale yellowish green. A few long sharp white hairs fringing the anal segment, these .20 mm. in length. Color of body greenish yellow. A dark green dorsal line. A trace of a greenish white lateral line, narrow, and not sharply defined. Spiracles pale straw yellow, suboval, inconspicuous, .03 mm. in diameter. Ventral surface and prolegs concolorous with body above. Legs semi-opaque, pale yellow brown. Length, 6.10 mm.; width at first thoracic, 1. mm.; width at anal segment, .94 mm.

*Fourth Instar.*—Head, 2.04 mm. in diameter, piceous black, but slightly bilobed, heavily corrugated. As before, head densely studded with spiculiferous filament-like white hairs, now .08 mm. in length on the average. Fore part of first thoracic segment greenish yellow, smooth. Dorsal shield green. As before, body profusely studded with fungiform white hairs, arranged in more or less regular transverse series. These hairs are now .04 mm. in height, .03 mm. in width at the saucer-tipped ends, and arise from pale green-yellow tubercles. Some of the fungiform hairs, especially along the posterior edge of the anal segment, are as long as .10 mm. Anal segment with some long fine sharp hairs, white and spiculiferous, some as long as .28 mm. Color of body grass green; the segmental sutures yellow, giving as a whole a blotched yellow-green coloration to the body. The lateral line narrow, greenish white, not distinct nor prominent, but developing more and more strongly as the stage proceeds. A greenish-white stripe, indistinct and crenate, along subventral ridge. Spiracles sub-oval, pale straw yellow, inconspicuous, .04 mm. in diameter. Ventral surface and prolegs concolorous with body. Legs pale yellow brown. Length, just after moult, 9. mm.; width at first thoracic, 1.70 mm.; width at anal segment, 1.40 mm.

*Fifth Instar.*—Head 3.70 mm. in diameter, well rounded, subquadrate, the sides fully rounded, the summit laterally angulated and forming by a slight median excision of the center a slightly elevated laterad submamillate prominence. Head in color brown black, but this coloration is obscured in the following way: A conspicuous orange blotch on either upper prominence; this is scarcely interrupted by a frontal crescent of the ground color of head from a second, but slightly smaller orange spot laterally on each side of face; below this, on the lateral front corner of face, a third smaller roundish concolorous spot. These three spots may be more or less confluent, but in most individuals are distinctly separated. Sometimes a still smaller fourth spot, roundish and of the same color, on the lower lateral posterior angle. Ocelli black fuscous; labrum, base of antennæ and labium pale. Head strongly vermiculate with short white hairs arising from minute pale tubercles; these hairs plumose, varying slightly in size, but average .12 mm. in length. Only a few low inconspicuous red-brown tubercles on summit of head laterally, these but .03 mm. in height. Body largest

at 3d, 4th, and 5th abdominal segments, tapering with considerable uniformity in either direction, but more rapidly at the extremities. Last abdominal segment well and rather strongly rounded. As before, body studded with fungiform white hairs, of slightly varying sizes, arising from rounded pale green-yellow tubercles arranged in more or less regular transverse rows. The largest of these hairs but .10 mm. in height, and .05 mm. in diameter at their saucer-tipped ends. Anal segment with a posterior fringe of fine sharp colorless spiculiferous hairs, of varying sizes, some as long as .40 mm., others but .14 mm. The segments of body divided into four subsegments, the anterior one much the widest, covering the whole half of segment, as wide as the other three together. The other three subequal and occupying posterior half of segment. The broad anterior subsegment with a dorsal division separating off a posterior portion of same width as hinder sections. A laterodorsal series of chitinous annuli, placed in middle of anterior half of each segment, smooth, dark green, .08 mm. in diameter. A laterostigmatal series of similar annuli placed directly above the stigmata, slightly smaller than the laterodorsals, but .05 mm. in diameter. A ventrostigmatal series, two to a segment near together, one in advance of the middle and the other a little behind the middle. Spiracles long oval, pale straw yellow, but slightly elevated, inconspicuous, .12 mm. in diameter. Color of body pale green, yellowish in all the wrinkles, and with a pale-yellowish bloom to all the surface, caused by the profusion of minute hairs. The dorsal line not prominent, fine, even, dark green. The lateral stripe fine, even, white or very pale yellow, fairly conspicuous. As the stage develops this line is slightly interrupted on the abdominal segments with a small blotch of orange, consisting of two fine vertical streaks, close together, on the segmental sutures. But this lateral line tends to become subobsolete on the thoracic segments, sometimes being but faintly represented, then again wholly lacking, and is usually also wanting on the last abdominal segment. A subventral yellowish stripe, even, narrow, not very prominent. First thoracic segment pale yellowish, smooth, hairless. Ventral surface a rather brilliant blue; legs pale yellow green, slightly infuscated at their tips; prolegs pale green. Length, just after moult, 17. mm.; at maturity, 24 mm. Width at first thoracic segment, 2.80 mm.; at anal segment, 2.10 mm.

*Pupa*.—Of the usual generic type. In color a vivid green, but with the wing cases and sometimes the abdomen clouded with creamish. The whole body, excepting the wing cases, but especially on the anterior half, covered with pale tapering wavy sharp hairs, .30 mm. in length on the average. Prothoracic stigmata prominent, velvety black. The cremastral spine pyramidal, truncate, longitudinally and irregularly sulcate; the cremastral hooklets .30 mm. in length, stout, castaneous. Spiracles long oval, .20 mm. in length, .08 mm. in their greatest width, with a slightly fuscous areola; the spiracles not at all prominent. The tongue case only very slightly extending beyond the tips of the wings. Length, 18.5 mm. Greatest height of thorax, 5.5 mm.; greatest height of abdomen, 4.7 mm.; width at eyes, 4.5 mm.; width at basal wing tubercles, 5.5 mm. Suspended by a median girdle, very loose but strong, and a Y-shaped posterior attachment.

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## THE IMMATURE STAGES OF THE CATNIP LEAF-HOPPER (*EUPTERYX MELISSÆ* CURTIS).

BY M. D. LEONARD AND G. W. BARBER,  
ALBANY, N. Y., AND THE BUREAU OF ENTOMOLOGY.

On October 27, 1919, the writers found a small patch of catnip (*Nepeta cataria* L.) on Inner Brewster Island in Boston Harbor. The plants were infested by a small leafhopper which was present in all stages in great abundance. The feeding of the insects had resulted in a characteristic yellowish-white discoloration of the leaves and injury to the plants was becoming apparent. Some of the infested material was collected and brought to the laboratory where the several nymphal stages were readily separated.

Eggs were found in considerable abundance in the petiole of the leaves. They were inserted at a slight angle or nearly parallel with the petiole, the cap apparently being flush with the surface. Egg-punctures could be readily distinguished by means of a small brownish discoloration of the epidermis.

Adults were submitted to both Prof. Herbert Osborn and Mr. W. L. McAtee who identified them as *Eupteryx melissæ* Curtis, as understood by McAtee (Ent. News, 30: 182-183, 1919).

Little is known of the life-history or habits of this species. The



insect has previously been recorded in the United States from New York (Van Duzee, Bull. Buffalo Soc. Nat. Sci., 10: 511, 1912), California (Baker, Invert. Pac., 1: 8, 1903), Pennsylvania and Maryland (McAtee, l.c.). No food plants are mentioned. In Europe where it has long been known, the species is common on various plants of the family Labiatae. Buckton (Mon. Brit., Cicadae, 2: 128-130, 1891) in his discussion of *E. melissae* states that there are probably two broods annually. He records finding the insect in October on garden mint and afterwards above the roots of the same plant throughout the winter and into the following spring. In January, 1887, he found active young nymphs after extremely low temperatures and after snow had been on the ground for five weeks. He states that he was unable to find autumn eggs. In the latitude of Massachusetts the insect undoubtedly spends the winter in the adult stage in the protection of leaves or trash on the ground. The writers were unable to gather any data on the length of time required by the insect to pass through its various stages.

*The Egg*.—(Fig. 1.) Length, .85 mm.; width, .17 mm.; pale translucent whitish, as time of hatching approaches becoming tinged with yellow and the eye spots of the embryo distinctly red; cylindrical, shining, somewhat curved, bluntly rounded at posterior end and tapering slightly, and more sharply pointed at the anterior end.

*Stage I*.—(Fig. 2.) Length, .92 mm.; width across eyes, .18 mm.; color, pale yellowish; eyes reddish brown; antennae, except basal segments, claws and extreme tip of beak, dusky.

*Stage II*.—(Fig. 3.) Length, 1.16 mm.; practically same as first stage excepting hind border of meso- and metathorax more concave and laterally expanded.

*Stage III*.—(Fig. 4.) Length, 1.4 mm.; width across eyes, .34 mm.; pale greenish yellow; eyes pale, slightly tinged with gray; setigerous tubercles on thorax slightly darkened, on abdomen not so. Wing-pads becoming apparent. Hairs long and whitish. Third and fourth segments of beak tinged with dusky.

*Stage IV*.—(Fig. 5.) Length, 2.1 mm.; width across eyes, .46 mm.; pale yellowish; eyes grayish, slightly tinged with green. Setigerous tubercles darkened; those on fifth and sixth abdominal segments not so. Light to dark brown markings on head and thorax as shown in figure. Wing-pads extend back nearly to fourth abdominal segment. Third and fourth segments of beak tinged with dusky.

*Stage V*.—(Fig. 6.) Length, 2.5 mm.; width across eyes, .57 mm. Above greenish yellow, irregularly mottled with light and dark brown as shown in figure. Hairs pale; setigerous tubercles darkened; those of fifth and sixth abdominal segments whitish. Below pale yellowish green; legs and eighth and ninth abdominal segments more greenish; remainder of venter tinged with cream color. Ninth segment of venter with a somewhat dusky stripe either side of the median line. Face below disc similarly marked. Second to fourth segments of beak tinged with dusky. Wing-pads extend back to fifth abdominal segment.

*Adult*.—(Fig. 7.) Following is the redescription of the species by McAtee (*l.c.*): "Head evenly and fully rounded both laterally and vertically. Length of vertex: interocular width:: 6:10. General color of upper surfaces of body and of the legs pale yellow; of forewings delicate green fading toward apex; eyes yellowish green. Head with 2 smaller spots on front, 2 larger on transition from front to vertex, and one of about same size on middle of hind margin, black. All of these spots vary from round to V-shaped or quadrangular; hence do not have the importance in distinguishing species assigned to them by European authors. Pronotum with two black spots, just behind median spot on vertex, and one lying just behind and to the side of each of these. Most of disc of pronotum covered by a greenish fuscous cloud, nearly touching the black spots. A dimly visible brown line connects the black spots, and, being a little more conspicuous at the ends, forms a curved brown dash, to the outer side of each of the posterior pair of dots. Scutellum with two pairs of black dots, the anterior larger and more separated.

"Forewings with irregular greenish fuscous markings, the color deepest at periphery (like blots the center of which has been sucked up), as follows: One larger and a few smaller on inner anterior angle of forewing, three larger (the median decidedly so) on main body of clavus and a long narrow one along whole claval suture; between second and third sectors, three, of which the anterior is largest; and one just outside latter on costa. The veins of the apical cells are margined with brown clouds and there are two black spots near exterior border of wing at a point two-thirds of the distance from base.

"Long triangular mark on cheeks below insertion of antennæ,

lower surface of thorax and entire abdomen black, the segments of latter margined posteriorly (sometimes very broadly) with yellow. Last ventral segment yellow, genitalia chiefly yellow in male, mostly black in female. Tarsi and apex of beak black. Length 3-3.25 mm."

#### EXPLANATION OF PLATES.

##### PLATE XX.

- Fig. 1. Egg.
- Fig. 2. First stage nymph.
- Fig. 3. Second stage nymph.
- Fig. 4. Third stage nymph.
- Fig. 5. Fourth stage nymph.
- Fig. 6. Fifth stage nymph.
- Fig. 7. Adult.

##### PLATE XXI.

- Fig. 8. Fore wing.
- Fig. 9. Hind wing.
- Fig. 10. Face of adult.
- Fig. 11. Genitalia of female.
- Fig. 12. Genitalia of male.

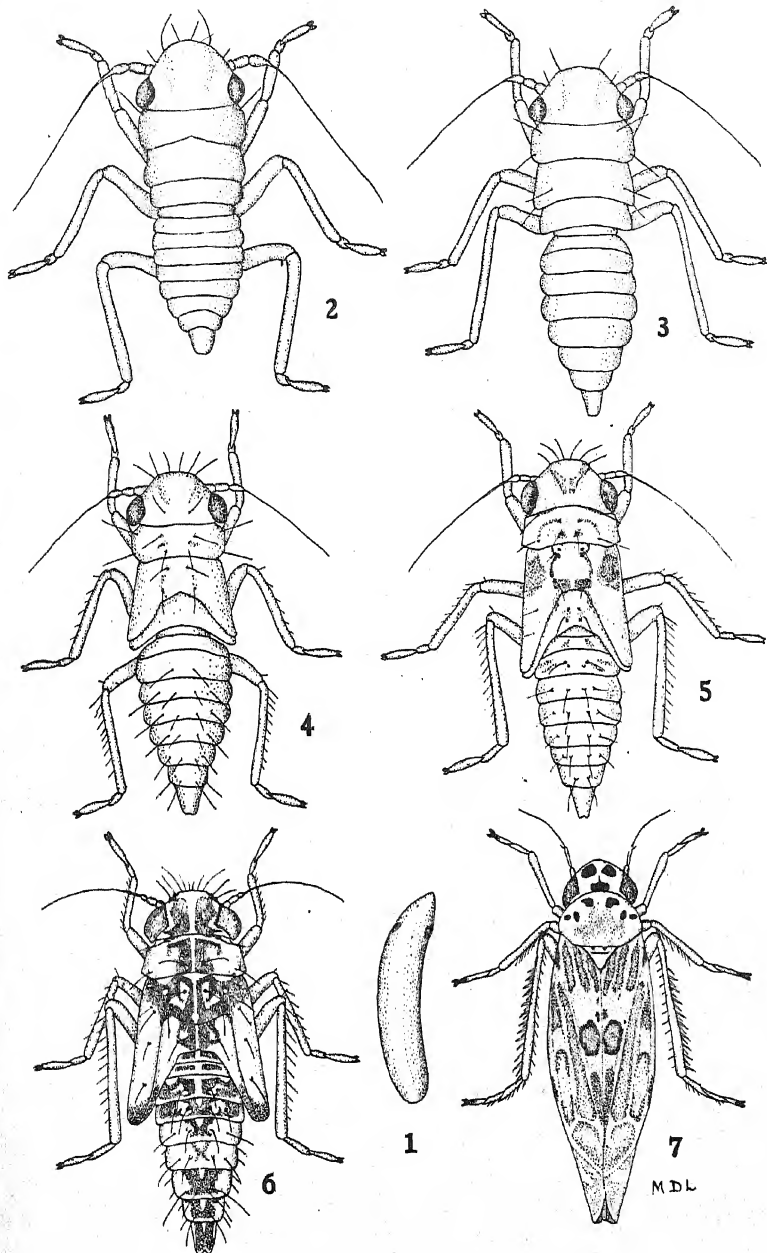
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### NEW SPECIES AND SYNOPSIS OF *STATIRA*.

BY CHARLES W. LENG,

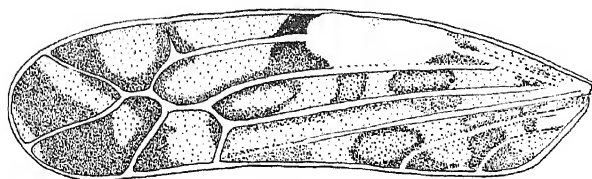
STATEN ISLAND, N. Y.

Mr. Charles Liebeck of Philadelphia sent me a few months ago seven specimens of *Statira* which he had found to be undescribed. These specimens led to my examining other species of the genus in the collections of the American Museum of Natural History, also in those of Mr. Charles Schaeffer, who has described several species, and of Mr. William T. Davis. There is some difficulty in using the synopsis by Dr. Horn. All our species have the last joint of the antennæ elongate and all have more or less setigerous punctuation of the elytra. Dr. Horn's synopsis was primarily based upon this punctuation which, as Mr. Schaeffer has already indicated (Brooklyn Mus. Sci. Bull., I: 175), is difficult to observe accurately. I have therefore tried to prepare a synopsis by which the species may be separated without using the punctures as a primary character. It is as follows:

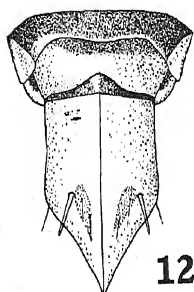


EUPTERYX MELISSÆ CURTIS

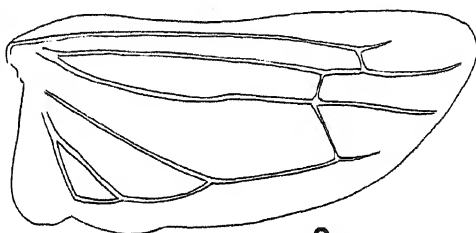




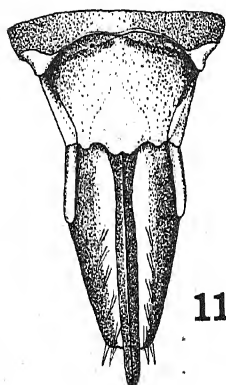
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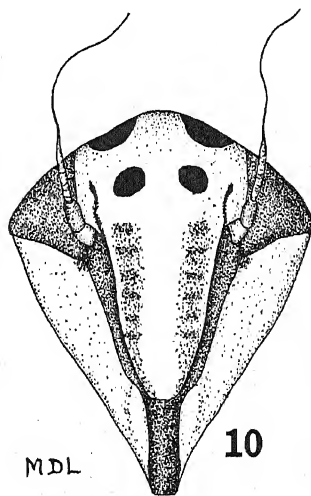
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EUPTERYX MELISSÆ CURTIS



## SYNOPSIS OF STATIRA.

- Elytra testaceous with median fascia and scutellar spot black, Mexico and Brownsville, Texas.....*pulchella* Mäkl.
- Elytra blue or greenish blue.....1.
- Elytra brown or piceous black.....2.
1. Head black, thorax reddish; setigerous punctures of elytra numerous, Georgia, Alabama, Florida, 7 to 9.5 mm.....*croceicollis* Mäkl.
- Head and thorax reddish; setigerous punctures of elytra few, Florida and Alabama, 9.5 mm.....*liebecki* new species.
2. Tibiæ sulcate on the outer edge.....3.
- Tibiæ rounded, not sulcate on outer edge.....4.
3. Tibiæ sulcate below apical half only.....5.
- Tibiæ sulcate nearly their entire length.....6.
5. Setigerous punctures of elytra few, mostly on third interval, Lower California, 7 to 11 mm.....*subnitida* Lec.
- Setigerous punctures more numerous, eyes less approximate; head, thorax, scutellum and legs rufo-testaceous, elytra and abdomen piceous, Lower California, 7.5 mm.....*colorata* Fall.
6. Setigerous punctures of alternate elytral intervals numerous; elytra shining piceous; thorax densely punctate, dull, paler than elytra, Texas, 7 to 9 mm.....*simulans* Schffr.
- Setigerous punctures of alternate elytral intervals numerous; elytra and thorax unicolorous, brown, subopaque, Arizona, 6 to 9.5 mm.
- pluripunctata* Horn.
4. Pronotum shining.....7.
- Pronotum opaque.....8.
7. Pronotum yellow, head and elytra piceous; setigerous punctures few, Pennsylvania, Maryland, Indiana, Kentucky, 7 to 8 mm....*resplendens* Melsh.
- Upper surface nearly unicolorous, brown or piceous.....9.
9. Brown; third, fifth, and seventh intervals with setigerous punctures, Arizona, 11 mm.....*robusta* Schffr.
- Black; third and fifth intervals with many setigerous punctures, Louisiana, Georgia, Florida, 7.5 to 10 mm.....*basalis* Horn.
- Color varying from brown to black; third and fifth intervals with few setigerous punctures, Vermont to Florida and Texas, 6.5 to 8 mm.
- gagatina* Melsh.
8. Setigerous punctures numerous on first, third, fifth, and seventh elytral intervals; smaller, thorax opaque, Arizona, 9 to 10.5 mm....*opacicollis* Horn.
- Setigerous punctures as in preceding; larger, more robust, thorax opaque, scabrous, Arizona, 12.5 to 14 mm.....*huachucae* Schffr.
- Setigerous punctures absent from the middle and partly the base of elytral intervals; thorax opaque, scabrous, Arizona, 11 mm.....*defecta* Schffr.

The last joint of the antennæ varies with the species as well as sexually, as follows:



<i>pulchella</i> .....	♂ = * preceding	♀ = * preceding
<i>croceicollis</i> .....	♂ = 5 preceding	♀ = 3 preceding
<i>liebecki</i> .....	♂ = 6 preceding	♀ = 4 preceding
<i>subnitida</i> .....	♂ = * preceding	♀ = 3 preceding
<i>colorata</i> .....	♂ = 3 preceding	♀ = * preceding
<i>simulans</i> .....	♂ = * preceding	♀ = 3 preceding
<i>pluripunctata</i> .....	♂ = 4 preceding	♀ = 3 preceding
<i>resplendens</i> .....	♂ = 5 preceding	♀ = 3 preceding
<i>robusta</i> .....	♂ = 5 preceding	♀ = 3 preceding
<i>basalis</i> .....	♂ = 7 preceding	♀ = 4 preceding
<i>gagatina</i> .....	♂ = 5-6 preceding	♀ = 3 preceding
<i>opacicollis</i> .....	♂ = 5 preceding	♀ = 3 preceding
<i>huachuca</i> .....	♂ = 4 preceding	♀ = 3 preceding
<i>defecta</i> .....	♂ = 4 preceding	♀ = 3 preceding

The extraordinary length of the last antennal joint in *basalis* ♂ is helpful in its identification.

#### NOTES AND DESCRIPTIONS.

##### *Statira gagatina* Melsh.

Mr. Andrew J. Mutchler has called my attention to the original descriptions of Melsheimer, including a described variety overlooked in my catalogue. These are:

- S. resplendens*, yellowish brown, head piceous, thorax yellowish; var.:  
*fusca*, uniformly yellowish brown;  
*S. gagatina*, black, tinged with bluish, glossy.

The word *gagatina* means like asphalt or jet and indicates that what is usually marked *gagatina* in collections is really what Melsheimer called *fusca*, while the rarer form, sometimes marked "*gagatina* var.," with shining black color, is nearer to his *gagatina*. In this connection it may also be recalled that Melsheimer very briefly indicated a variety *viridis* of *Arthromacra ænea* as "green, brilliant, very slender," which has been overlooked in our catalogues. This may be one of the green species I have heretofore described but the few words he used do not tell which, if either.

With *gagatina* in the synopsis I have included a form from Florida, of which I know two specimens, one in my collection and another in Mr. Schaeffer's. These are larger and more slender, and the elytra have apparently only four setigerous punctures on the fifth interval; the elongation of the last antennal joint is, however, very nearly the

same as that seen in *gagatina*. My specimen is a female and not so shining as the male in Mr. Schaeffer's collection, which was collected by Mr. H. L. Dozier at Gainesville.

***Statira liebecki* new species.**

Elongate, reddish testaceous, elytra dark bluish-green, shining, with a few setigerous punctures.

Head reddish testaceous, dull with fine close punctulation, sharply constricted at neck; eyes large, black, moderately coarsely granulate; antennæ reddish testaceous, filiform, second joint short, third twice as long as second, succeeding joints gradually shorter except the last, which is as long as six preceding joints in the male, or about four in the female.

Prothorax reddish testaceous, dull with fine close punctulation, longer than wide, rounded at sides, truncate in front, truncate and strongly margined behind. The margin projecting at base forms spiniform hind angles. Elytra shining, dark bluish-green, striate, striæ closely punctate, intervals slightly convex with setigerous punctures on third, fifth, and seventh, principally toward apex. The number of setæ is about four on third interval, one being usually in front of the middle; the total number is about eight, though there are also punctures without setæ on the first interval near apex, and shorter setæ at base of elytra. Body beneath and legs reddish testaceous, abdomen piceous; tibiæ rounded externally. Length, 9.5 mm.

Habitat, Florida and Alabama.

Holotype male, Enterprise, Fla.; allotype female, Spring Hill, Ala., May 15, 1919 (H. P. Loding), both in my collection. Paratype males, Enterprise, Fla., in collections of Charles Liebeck in Philadelphia, American Museum of Natural History in New York, and Staten Island Institute of Arts and Sciences; also one from South Bay, Lake Okechobee, Fla., April 29, collected by William T. Davis, Staten Island, N. Y., and in his collection. Paratype female, Crescent City, Fla., April 24, in the collection of American Museum of Natural History.

This species differs from *S. croccicollis*, also found in Florida, by the paler color of the head and fewer setigerous punctures of the elytra; in *croccicollis* there are from five to seven on the third interval, distributed over the entire length of the elytra, and about four on the fifth interval. It differs from *S. resplendens* by the pale head, paler color beneath, and blue elytra; *resplendens* has piceous elytra and is found in Pennsylvania, Maryland, South Carolina, Kentucky, etc., apparently not extending as far south as Florida.

In reference to the larva of *Statira* there seems to have been but little published, and it may be worth while to quote Dr. Sharp's remarks on the family Lagriidæ (Cambridge Natural History, Insects, part II, p. 264). "The early instars are similar to those of the

Tenebrionidæ, except that the larva is less retiring in its habits and wanders about on foliage; it is of broader form than that of most of the Tenebrionidæ. The pupa has long projections at the sides of the abdominal segments."

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## SUPPLEMENTARY NOTES ON OPHIDERMA FAIRM. (HEMIP.-HOMOP.).

By LEWIS B. WOODRUFF,

NEW YORK CITY.

In 1894 Dr. Goding published a description of a supposedly new species of this genus under the name *flaviguttula*, based upon one female specimen taken in Illinois. A discussion of its status was included in a paper by me in the December 1919 number of the JOURNAL OF THE NEW YORK ENTOMOLOGICAL SOCIETY (Vol. XXVII, pp. 251-3), in which were listed four specimens of *Ophiderma flaviguttula*, all females, including one in the National Museum determined as such by Dr. Goding himself. In the December 1920 number of that JOURNAL (Vol. XXVIII, p. 214) I cited still another example, taken at Newark, N. J. The foregoing were all so assigned on the basis of the accuracy of determination by its author of the National Museum specimen, notwithstanding the fact that the original description made no reference to the mid-elytral band present in all of them, as well as in my so-called variety *definita*, and in spite of certain other slight inconsistencies pointed out in my paper first cited.

Since those papers were published Dr. Goding has generously presented his type material to the National Museum, and on a recent visit to Washington I availed myself of the opportunity to examine his type of *flaviguttula*. It proves to be a female of *pubescens* Emmons, as suspected by Van Duzee in his "Studies" (Bull. Buffalo Soc. Nat. Hist., 1908, Vol. IX, p. 98). That it should have been redescribed by Dr. Goding is not at all surprising in view of the fact that Emmons's description (Nat. Hist. of N. Y., Vol. V, p. 157) was evidently based upon a male specimen, and that his figure (loc. cit., Pl. 13, Fig. 2—erroneously cited in the text as Fig. 3), while a good representation of that sex of his species, naturally gave no clue to the appearance of

the female, which was doubtless unknown to him. At any rate Dr. Goding apparently regarded Emmons's description of *pubescens* as a redescription of the very similar but larger male of *salamandra* Fairmaire; and finding no description or figure that fitted his female specimen, nor, by reason of his consignment of Emmons's species to synonymy, any recognized male with which to associate it, felt warranted in describing it and giving it a name. Abundant material of both sexes of *salamandra* and *pubescens* are before me, including copulating pairs of each, and there can be no doubt that *flaviguttula* Godg. must fall into the synonymy of *pubescens* Emmons.

This raises my *defnita*, which through my misconception of Goding's *flaviguttula* I had described as a variety of that species, to full specific rank. The five specimens referred by me in the above-cited papers to Dr. Goding's species, including not only the one determined by him as such, but the Bronxville specimen described by me under his designation (N. Y. ENT. SOC. JOUR., Vol. XXVII, p. 253), are to be regarded as pale examples of *defnita* Woodr.

This species is strongly characterized by the dark mid-elytral band, with more or less bright red and black defining the pattern on posterior half of pronotum. Figures 5 and 6 of plate XXIII accompanying my paper first referred to exhibit respectively the pale and dark forms of this species, figure 5 being that of the Bronxville specimen covered by the detailed description on page 253 of that paper, and figure 6 the designated type of *defnita*. In many specimens, too, the normal anteapical vitta, not evidently indicated in the figures, though referred to as obsolete in the description of the Bronxville specimen, appears as clearly defined as are the other markings. The sinuation of dorsal outline shown in figure 6 is individual, and not a specific character.

It should perhaps be noted that while I regarded the prevailing dark form with sharply defined colors and pattern as worthy of a distinctive though varietal name from what I then supposed to be the valid name of the pale form, I do not regard the converse to be true. In this group as a whole the several species frequently exhibit great variation in the amount of their pigmentation; and varietal names based upon that character alone, unless circumstances seem to require them, but add cumbersomeness to the nomenclature. The rather unusual pale forms are simply pale examples of *defnita* Woodr.

An interesting specimen of *O. evelyna* Woodr. has come to hand. It is structurally a perfectly normal female; but the color and pattern of its left side, instead of showing the usual unmarked green of that sex, is as in the male—pale yellow; dorsum from about middle to apex light reddish brown, crossed by a broad subapical transverse vitta of the anterior yellow. The right side is wholly normal. Similar masquerading in the colors of the opposite sex has been observed in the allied genera *Cyrtolobus* (including *Atymna* and *Xantholobus*) and *Telamona*; though here one needs to be on one's guard in sex determination because of the frequency of parasitism, and consequent distortion and malformation of the genital organs. This species, *O. evelyna*, proves to be a very common one in our southern states, in Alabama apparently favoring *Quercus coccinea* as its host plant.

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## PROCEEDINGS OF THE NEW YORK ENTOMOLOGICAL SOCIETY.

MEETING OF JANUARY 16.

A regular meeting of the New York Entomological Society was held at 8 P.M., on January 16, 1923, President H. B. Weiss in the chair, with twelve members and three visitors present.

On nomination by Mr. Woodruff the following new members were elected:

Walter Everts, 245 West 69th St., New York City.

Dr. Charles A. Leale, 500 Madison Ave., New York City.

Mr. Davis exhibited six boxes of "Tabanid Flies of Staten Island and Long Island" and spoke of the impetus given to his studies by the work of Daecke, Hine, and Dr. Bequaert, as well as of the characteristics of various species of deer flies, horse flies, etc. Also of George Franck's experiences in collecting Tabanids from a tame cow.

Dr. Bequaert said that it was essential to have a really tame cow for the purpose and gave some instances of narrow escapes in Africa from cows that were only apparently tame. He had found a tent closed at one end with mosquito net, a help in collecting, and had obtained many specimens from dark corners on river steamboats. He gave some figures on the number of species thus far known from New Jersey, 82, Staten Island, 46, Long Island, 35, whole world, 2,200, as indicated by Sourcouf's work in *Genera Insectorum*. He reviewed Enderlein's work on the preliminary classification and that of Marchand and others on the life history. The difficulty of keeping Tabanids in captivity is increased by their exceedingly rapid flight, in which they destroy themselves against the cage. A double cage 20 x 15 feet with walls of mosquito net within the wire gauze had been tried.

Messrs. Davis, Woodruff, and Hallinan discussed the matter further, Tabanid liking for dark places, the biting of the female unpleasantly remembered by all, and their wonderful speed which Mr. Hallinan said he had computed from marked specimens and measured distances at (800?) miles an hour.

Mr. Dickerson spoke on "New Jersey Tingidæ" and especially on recent work by Mr. Weiss and Mr. Barber, with the 28 species known in New Jersey published in circular No. 54 New Jersey Department of Agriculture.

Mr. Davis recalled Mr. Heidemann's interest in these lace wing bugs.

Mr. Woodruff called attention to an insect article in the *Youth's Companion*.

Announcement was made of several matters for Messrs. Decker, Ditmars, and Brady.

#### MEETING OF FEBRUARY 6.

A regular meeting of the New York Entomological Society was held at 8 P.M., February 6, 1923, in the American Museum of Natural History, President Harry B. Weiss in the chair, with eleven members and two visitors present. The following new members were elected:

Chas. P. Alexander, Fernald Hall, Amherst, Mass.

A. M. Nadler, 413 Stratford Road, Brooklyn, N. Y.

Ralph B. Lott, Dayton, N. J.

Paul L. Mitchell, 408 Sumner Ave., Brooklyn, N. Y.

on nominations made by Messrs. Notman, Lutz, Weiss, and Davis.

Mr. Woodruff spoke of the coleopterous genus *Polydrusus* Germar, giving its history, definition, and distribution over the world, in part by commercial introduction. The life history of some species was then given and the American species specially considered, leading to the conclusion that specimens found by Mr. Woodruff in Alabama were undescribed.

Mr. Nicolay gave an account of an expedition made by Mr. Quirsfeld and himself as guests of Mr. Notman to Wallface Mt. in the Adirondacks in July, 1922. Among the interesting beetles found were *Elaphrus olivaceus*, *Sphaeroderus canadensis* and *brevoorti*, *Nomarectus bilobus*, *Pterostichus punctatissimus*, etc.

Mr. Notman supplemented his remarks by describing Scott's Pond near which the tents were pitched as being at about 3,000 ft. elevation and near the junction of the Hudsonian or Spruce zone with the Canadian zone of ash and maple trees. A large number of beetles caught by the party were exhibited.

Mr. Nelson spoke at some length on the biological control of certain insect pests, in which he had taken part. The cottony cushion scale at New Orleans in 1916 had been thus controlled by the introduction of Australian lady beetles; the gray scale of citrus in southern California by a small fly. He also spoke of the Argentine Ant in New Orleans marching in single file, 50 feet long, and the control effected by syrup carrying an arsenite weak enough not to kill the ants until after they had carried it to their nests; and of the pink boll worm of cotton introduced from Egypt and controlled only by burning the infected plants. His description also of an insect, possibly a pentatomid, watching over its eggs in Porto Rico developed an interesting discussion.

## MEETING OF FEBRUARY 20.

A regular meeting of the New York Entomological Society was held at 8 P.M., on February 20, 1923, in the American Museum of Natural History, President Harry B. Weiss in the chair, with eleven members present.

Mr. Edgar Nelson, 42 State St., Flushing, N. Y., was nominated for active membership by Mr. Leng.

Mr. Davis spoke with regret of Dr. Bequaert's approaching departure for Africa; he also referred with praise to Mr. J. S. Wade's catalogue of Government Entomological publications.

Mr. Woodruff having taken the chair, Mr. Weiss presented by diagrams the "Money Losses Due to Insects," comparing them with those due to climatic factors and showing the much greater irregularity and importance of the latter. Estimates received from thousands of farmers were used in compiling statistics for a few years past for each important crop; the number of years for which such figures were available was admitted to be insufficient for entirely satisfactory results, but it was maintained that they were more illuminating than some estimates expressed in dollars prepared by theoretical writers. Though some such estimates were quoted Mr. Weiss preferred to use percentages which showed plainly the fluctuating character of climatic damage and the comparatively uniform percentage of loss from insects excepting the recent rapid increase in boll weevil damage, offset to some extent by the advance in price of cotton.

Mr. Weiss having resumed the chair, Mr. Shoemaker exhibited seven boxes of admirably mounted Chrysomelidæ comprising the second half of his collection of 535 species, eight boxes comprising the first half, having been shown on a previous occasion. His personal collecting for 21 years in D. C., in the Catskills, Adirondacks, and on Long Island as well as many additions from Kunze's Arizona material and from exchanges were included. The neat arrangement of the collection as well as the many rarities were greatly admired. Among his 3,909 specimens were large series of *Calligrapha rowena*, *amelia*, and an apparently new species; a series of *Disonycha discoidea* with one specimen retouched with paint to recall its actual color in life; and there was added the type of *Saperda shoemakeri* to be described by Mr. Davis.

After a general discussion, during which Mr. Davis read abstracts from Mr. Blatchley's letters from South America, Mr. Nicolay spoke of his visits to Washington, and Dr. Sturtevant presented his entomological collections in England, Norway, Sweden, and Holland, to the Museum. The meeting adjourned.

## MEETING OF MARCH 6.

A regular meeting of the New York Entomological Society was held at 8 P.M., on March 6, 1923, in the American Museum of Natural History, President Harry B. Weiss in the chair, with fourteen members and three visitors present.

Mr. Davis spoke of Dr. Bequaert's approaching departure for Africa and the propriety of the Society passing a resolution relating thereto. He read one

he had prepared and on motion by Mr. G. W. J. Angell, seconded by Mr. Woodruff, it was adopted as follows:

"The members of the New York Entomological Society having learned that Dr. Joseph Bequaert is about to depart for Africa for a protracted stay, wish to express their appreciation of the great interest he has taken in the Society since he became a member in 1916, and also of the benefits that have come to it by reason of his learned discourses on a great variety of entomological subjects. It is their hope that his contemplated visit to the Congo River, like those of previous years, will be of value to him, and that with an even greater fund of information, he will ultimately return to America and the meetings of our Society."

Mr. Edgar Nelson, 42 State St., Flushing, N. Y., was elected an active member of the Society.

Dr. A. H. Sturtevant made an address illustrated by blackboard drawings on "The Seminal Receptacles and Accessory Glands of the Diptera" in which he praised the early work of Leon Dufour, 1844, on the internal genital apparatus of the females and the later work of Townsend and Pointely on Tachinidæ before explaining his own discoveries with better optical apparatus than Dufour had. The various types of spermotheca and of ventral receptacles were carefully described and illustrated and, while it was admitted that the relationships discovered could not be used conveniently in a key, yet they threw a great light upon the correct position in classification of some hitherto doubtful forms. Some of these, *Gymnopa* for example, were specially discussed at the close of his remarks.

Mr. Bird expressed his great admiration for the success of Dr. Sturtevant's work on these minute flies and the importance of his findings.

Mr. Nicolay read portions of his forthcoming paper written in conjunction with Mr. Weiss "On the Genus *Brachys* in America" which has been in progress since 1919. He said that eight species and three varieties occurred and that, apart from coloration, the form of the last ventral segment in the female had been found the most useful character. He showed his own and Mr. Leng's collection and stated that the plates had been drawn by Mr. Olsen.

Mr. Mutchler spoke of the recent finding in California of a specimen of *Trachychele opulenta*, within a felled sequoia which from its position must have lived 1,200 years ago. This led to a general discussion of sequoia growing in eastern United States. Mr. Davis mentioned one in Central Park; Mr. Bird one in Delaware 35 feet high; and to the relation of tree ring growth with sun spots.

Mr. Varrelman spoke of Van Duzee's work on beetles and of his own on *Teredo*.

Mr. G. W. J. Angell spoke of his pleasure in meeting his old friends in the Society again.

Mr. Fountain of Exeter, N. H., present as a visitor, spoke of his experiences in bee keeping.



## MEETING OF MARCH 20.

A regular meeting of the New York Entomological Society was held at 8 P.M., on March 20, 1923, in the American Museum of Natural History, President Harry B. Weiss in the chair, with twenty-one members and three visitors present. The Librarian reported accessions.

Mr. Bird read a paper on "Leiby's Recent Work on Polyembryony" illustrated by a Riker Mount showing the image and larva of a species of *Plusia* with 1,732 examples of *Copidosoma truncatellum* which had emerged, all being the development from a single polyembryonic egg.

The paper and remarks are a complimentary resume of R. W. Leiby's publication in Journal of Morphology, Vol. 37, No. 1, on the polyembryonic development of *Copidosoma gelechia*.

After an eight years study, that author has brought out an exhaustive cytological treatment of the processes of polyembryony, illustrated by nearly one hundred figures, and it becomes the foremost exposition yet accorded the subject in America.

Attention is called by the speaker to the possible value in the remarkable increase in parasitic, polyembryonic species, and that they may be of much economic moment, if of avail.

Mr. Notman exhibited "Beetles from Sylvan Beach, Lake Oneida" and described the locality as flat, sandy marshes, with a fifty foot wide sandy beach in places. Some unusual captures resulted, enormous quantities of *Dyschirius pallipennis*, and large numbers of *Cicindela hirticollis* and *Omophron tessellatum*. A slow stream flowed into the lake; along its banks *Georyssus* was common and *Omophron americanum* replaced the *tessellatum* of the beach.

Mr. J. C. Bridwell, present as a visitor, gave some interesting notes on Bruchidae among other items:

*Zabrotes subnitens* on Strawberry blossoms.

*Bruchus musculus* on *Desmodium bracteosum*.

*Bruchus perforatus* on *Astragalus canadensis*.

*Bruchus discoidens* on Bindweed.

He also spoke of the Chrysomelid habit of covering thin, delicate eggs with excrement as a protection from desiccation. *Dibolia*, for instance, bites a hole in plantain leaves and deposits there an egg bearing the family badge of excrement.

Mr. Jones spoke briefly of a recent visit to Bermuda and Mr. Nelson of his intended summer at Mt. Morris, N. Y.

## MEETING OF APRIL 3.

A regular meeting of the New York Entomological Society was held at 8 P.M., on April 3, 1923, in the American Museum of Natural History, President Harry B. Weiss in the chair, with thirteen members present.

The following new members were elected:

Loren B. Smith, Japanese Beetle Laboratory, Riverton, New Jersey.

A. F. Satterthwait, U. S. Entomological Laboratory, Webster Groves, Md.

W. R. Walton, Bureau of Entomology, Washington, D. C.

Wm. O. Ellis, 10 Court St., Arlington, Mass.

Mr. Erdman West, New Jersey Agricultural Department, Trenton, N. J., was proposed by Mr. Weiss.

Mr. Leng spoke of the genus *Statira*, describing the peculiar elongation of the last joint of the antennæ and the elytral sculpture and vestiture that characterize its species. The work of several authors, particularly Dr. Horn and Mr. Schaffer, was mentioned, and finally a new species from Florida discovered by Mr. Chas. Liebeck, of Philadelphia, was exhibited and its differences displayed.

Mr. Davis exhibited Walking Stick insects found on Long Island and Staten Island, especially females of *Manomera blatchleyi* from Illinois and Indiana, with females of var. *atlantica* from this vicinity. Their differences were explained and the curious fact that no males of *atlantica* were known was pointed out.

Mr. Davis also exhibited Cicadas described in the last number of the JOURNAL.

Dr. Sturtevant exhibited a collection of Diptera and Hymenoptera arranged to show many instances of apparent mimicry.

Mr. Notman exhibited the rare butterfly *Erora lata* collected at Keene Valley, N. Y., in various years at dates ranging from May 16th to June 16th.

Mr. Dickerson exhibited a roach pressed between layers of cardboard to show its resemblance to fossil imprints.

Mr. Shoemaker exhibited Tenebrionid larvæ found in the excelsior packing of a box received from Germany.

Dr. Janvrin exhibited a *Cicmdela sexguttata* from Teaneck, N. J., collected in May, nearly immaculate and violet in color.

Mr. Mutchler pointed out that while the varietal name *violacea* was at present applied to specimens from Kansas exclusively, it was very unlikely that the types of Fabricius were collected there.

Dr. Lutz spoke of his approaching trip to Paradise Key, Fla., a hummock in the Everglades, where the Cuban Pine and Royal Palm, 60 years old, grew on account of absence of killing frost and where in a reservation of virgin condition, he hoped to obtain some interesting insects.

Mr. Sherman spoke of the high prices obtained for certain natural history books at recent auction sales, averaging at least 25 per cent. more than any previous records. A list of birds by Theodore Roosevelt, which once sold for forty cents, reached the climax by bringing \$27.50.

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**Errata.**—Volume XXXI, p. 156, for *Acer saccharinum* read *Acer saccharum*; for *Quercus prinus* read *Quercus prinus*.

**Editorial Notice.**—Because of the increasing cost of publication, the subscription price of the JOURNAL OF THE NEW YORK ENTOMOLOGICAL SOCIETY will be raised to \$3.00 beginning with volume XXXII and the custom of giving twenty-five free separates of their papers to authors will be discontinued. Separates will be sold as heretofore, but no order for less than fifty will be accepted.

# INDEX TO NAMES OF INSECTS AND PLANTS IN VOLUME XXXI.

Generic names begin with a capital letter. New genera, subgenera, species, subspecies, varieties, and *nomina nova* are printed in italics.

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### CRITICAL OBSERVATIONS IN THE MEMBRACID GENUS *CYRTOLOBUS* GODING. (HEMIP.-HOMOP.)

BY LEWIS B. WOODRUFF,  
NEW YORK CITY.

Since the publication in 1908 of Mr. Edward P. Van Duzee's most useful "Studies in North American Membracidae"<sup>1</sup> nothing has appeared of a systematic character concerning our representatives of the genus *Cyrtolobus*, other than one or two brief papers correcting or modifying certain conclusions there presented, or for purposes of local lists. Contemplating the preparation of as complete a review of this genus as might be practicable, I have devoted much time to field work and study during the past three years in an attempt to solve the many problems which have presented themselves as the work proceeded. Considerable progress has been made; but so many unforeseen difficulties have arisen, including the discovery of undescribed species in every locality visited, with the resulting presumption that our knowledge of its components is far from complete, that it has become apparent I cannot yet offer such a review as would be satisfactory. Nevertheless certain results already attained, particularly with respect to species of the eastern United States, will be of value and interest to other students of the group; so I am impelled to formulate them now, that they may be made available. It is to be hoped, however, that the preparation of such a review by a competent authority may be warranted and prove feasible within a reasonable time.

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<sup>1</sup> Bull. Buf. Soc. Nat. Hist. IX, p. 29. (1908).

In setting forth the characters of those species which heretofore have not been recognized, as well as of the undescribed males of species of other authors, but little reference is made by me to facial outline or pronotal punctuation, due to my inability to discover sufficient stability in these characters to render them of more than questionable value in specific diagnosis. For the delineation of the species treated I have been fortunate in securing the services of Mrs. Beutenmuller. It should be pointed out, however, that the figures are intended to portray in the respective species represented only the form and pattern of the pronotum, with the character of the infuscation of the fore wings, and that neither the texture of the latter, the form of the abdomen visible in nature through their hyaline area, nor the details of coloring, vestiture and structure of the legs are intended to be indicated.

Acknowledgment is here made to the custodians of the material in the collections of the United States National Museum, American Museum of Natural History, Boston Society of Natural History, New York State Museum at Albany, and Brooklyn Museum of Arts and Sciences, as well as to Messrs. W. T. Davis, C. E. Olsen, W. D. Funkhouser, Charles S. Johnson, and Mrs. Annie Trumbull Slosson for the privilege of examining what in the aggregate proved to be a most interesting array of the forms to be found throughout the continent north of Mexico, and which also emphasized the extreme confusion of the genus so far as the recognition of described forms is concerned. To Dr. Funkhouser in particular I am indebted for most helpful criticism and discussion, both by correspondence and through charming hospitality extended to me at his most delightful home.

As it is a prerequisite to a correct understanding of the genus that those species already described be certainly recognized, I shall not only present my conclusions with respect to the identity of those regarding which there seems to be any confusion, but somewhat in detail the steps by which I have reached such conclusions.

The order in which my consideration of the several species is presented conforms for the most part to that followed in Van Duzee's List of the Hemiptera of America north of Mexico, such comparatively few departures or transpositions as I have made

in the sub-genus *Cyrtolobus* s. str. being in the interest of what seems to me a closer approximation to their natural sequence from the species in *Archasia* and *Smilia* to those in *Atymna*.

*Cyrtolobus ovatus* Van Duzee.

*Cyrtolobus ovatus* Van Duzee was described from female specimens only. Its color, given as "soiled yellowish testaceous" in the dried specimen, is accurate for the living specimen as well; but occasional examples are taken that are pale green. There is frequently present, too, a sub-obsolete anterior oblique vitta, with more or less obscure indications on the dorsal carina of the translucent spot and anteapical vitta. Its deflexed posterior pronotal process fully attains the apex of fore wings. The male, hitherto undescribed, seems to be of two color forms, one black and the other pale brownish. The latter may be described as follows:

*Cyrtolobus ovatus* Van Duzee. (Plate V, Fig. 41.)

MALE: Pronotal arch much less arcuate than in the female, only slightly deflexed at tip and attaining only to middle of terminal areole. Mid-dorsal compression deep and very pronounced. Color light brown, somewhat shining, becoming a little reddish back of anterior oblique vitta. The latter is white, arises from middle of lateral margin and curves forward only about half way to crest. Translucent spot at mid-dorsal carina small. Anteapical white vitta complete, vertical, prominent.

Body beneath pale.

Fore wings sub-hyaline, slightly clouded at terminal margin.

Legs pale, femora above a little darker.

Length 4 mm.

Allotype ♂. Lakehurst, N. J. VI/17/'17. In my collection. Taken on *Quercus ilicifolia*

This brown form I have taken, probably while copulating, with a female from a very small sapling of *Quercus minor* at Hazen, Alabama, the sapling so small it could hardly have harbored another species. The black form, also taken at Lakehurst, N. J., and in the south, is the counterpart in form and markings of the brown one, jet black replacing the brown, including the body beneath and femora above, the black throwing into greater relief the white vittæ. The brown male is here figured.

*Cyrtolobus arcuatus* Emmons.

*Cyrtolobus arcuatus* Emmons is one of the least abundant species in the genus, though occurring both north and south in the eastern United States. Emmons's published figure shows well the form of the female, though of rather unusual coloring, the nearest approach to which that I have seen is a specimen from Massachusetts in the C. W. Johnson collection. A series of nine female specimens taken by me in Alabama range from no vitta to a strongly marked anteapical whitish vitta, quite broad, bordered anteriorly with a narrow dark band, sometimes rather rufous; the pronotum otherwise brownish testaceous, three of them peppered with black anteriorly and along dorsal crest. At Yaphank, Long Island, N. Y., I have taken four other females similarly marked, but much more contrastingly, the anteapical vitta broadly white, bordered both before and behind with narrow dark bands. At the latter locality four male specimens have been taken; in the American Museum of Natural History, New York City, is one from Berkley Heights, N. J., collected by the late E. L. Dickerson, and in the National Museum is one from Maryland, all of which I unhesitatingly place as males of this species. Hitherto the male has been unknown, and these six specimens are all I have seen. A description of that sex is as follows:

*Cyrtolobus arcuatus* Emmons. (Plate I, Fig. 3)

**MALE:** Pronotum arching moderately, very slender, no anteapical sinus, tip slightly deflexed as in the female, and almost attaining apex of fore wings.

Color dark testaceous, thickly irrorate with black on metopidium and forward part of pronotum. Anterior oblique pale vitta broad, the mid-dorsal translucent pale spot equally broad, directed from crest to bottom rearward and reaching that vitta at its middle. Immediately back of this translucent spot, only narrowly separated from it, commences an even broader anteapical vitta, inclined strongly rearward from dorsal to lateral margin, generally paralleling the direction of the elongated translucent spot.

Body beneath dusky.

Fore wings hyaline; apical border infuscated.

Legs yellowish testaceous, shining.

Length 5.8 mm.

Allotype ♂, Yaphank, Long Is., N. Y. VI/9/'12 (W. T. Davis), in my collection.

Accompanying the figure of the male specimen above described is appended that of a female (Fig. 4) taken by me at the same locality June 15, 1923. It will be noted that its anteapical vitta has an inclination approaching that of the male, though not so pronounced—an inclination not found, at least in similar degree, in any other species of the genus known to me. While the male has not yet been taken in copulation, I have no doubt that the specimens above described are correctly assigned to this species, by reason of their corresponding general facies.

*Cyrtolobus fuliginosus* Emmons.

In 1854 Emmons figured a species of *Cyrtolobus*, with a very brief description,<sup>1</sup> under the name *Cyrtosia fuliginosa*. There seems to be no confusion as to its identity—very dark, the markings often obscured, with a distinctive pronotal structure, its apex, slightly deflexed, almost or quite attaining that of the fore wings, with a slight anteapical sinuation usually faintly indicating a clear spot on the dorsal carina. The mid-dorsal translucent spot, however, is lacking. Such is Emmons's *fuliginosus* of the female sex. It is frequently almost black. Occasionally, however, specimens are found that show on this blackish surface more or less evident markings, including the pale oblique vitta which occurs so often throughout the genus; but almost always the anteapical vitta is lacking. From these it is but a step to still paler specimens through various shades of brown, reddish and pink. The latter forms are found much more frequently than the blackish unmarked ones, though in the same localities, and in almost all collections to which I have had access they bear names of various species assigned to this genus, but in no case that of the species figured by Emmons above referred to. The specimen in the Harris collection at the Boston Society of Natural History Museum which bears Say's identification as his *vau* is one of these pale forms. In structure, however, they seem to me absolutely indistinguishable from that of *fuliginosus* Emm., and I have no doubt that these paler forms are of the same species.

Its distribution seems to be general throughout the eastern United States. In Alabama I have found the reddish or pinkish

<sup>1</sup> Nat. Hist. of N. Y., Agri. V., p. 154; Plate 13, Fig. 15.

form to the exclusion of the blackish one; and there succeeded in getting a pair in copulation, thus definitely ascertaining the identity of the male of this species, hitherto not positively known. Figures of this pair are presented with this paper, the male of which is described below in detail and designated as the allotype of the species. It will be noted that this male is prevailingly black, as are some twenty other specimens of this sex collected with these reddish females in the same locality. Four reddish males in my collection, also taken with them, as well as similar specimens examined by me from various parts of the country, north and south, I regard as the same species; and as the blackish male is found with the reddish female, even copulating with it, not even racial standing can be given the conspicuously different color phases found in both sexes of this species.

**Cyrtolobus fuliginosus** Emmons. (Plate II, Figs. 13, 14.)

MALE: In form like the female, but smaller, the low and slender pronotum not attaining apex of fore wings.

Face deep, margins of genæ rounded so that contour of face is almost semicircular, with clypeus very little produced.

Metopidium rising vertically from base in a plane with and exceeding in height that of face, thence abruptly back at an interior angle of about  $120^{\circ}$  to the summit of the crest forward of middle, with a very slight sinus over humeri, thence sloping to apex, which barely exceeds basal angle of terminal areole of fore wings, a strong but hardly translucent mid-dorsal compression, and a slight sinus at anteapical vitta. Face, metopidium and whole of pronotum anterior to oblique vitta black densely irrorate with pale testaceous. Anterior oblique vitta whitish testaceous, arising at the side margin back of the middle, arching gradually forward to above post-humeral sinus and thence rising abruptly and vertically to dorsal carina. The posterior vitta vague, vertical, whitish testaceous interrupted by the brownish black pigment of the pronotum, which is almost uniform back of the anterior vitta except where crossed by this posterior vitta. Mid-dorsal compression slightly reddish.

Body beneath black, abdominal ventral segments pallid.

Fore wings slightly enfumed, not so much as in the female, margin narrowly fuscous.

Legs pale testaceous.

Length 5.20 mm.

Allotype ♂, Hazen, Ala. IV/6/'21. In my collection.

The above described male was taken with a female *in copula* on *Quercus rubra*. Specimens of this sex before me range from almost wholly black to those in which the black pigment is greatly reduced. There seems to be no intergradation, however, between the blackish forms and those in which pink or red replaces the black. In all the forms the anteapical vitta in this sex is usually pronounced, often extremely broad; in the reddish form it shows a greater tendency to be obsolete as in the female.

*Cyrtolobus acuminatus* new species.

The following new species is one that should be recognized readily when found by its contrasting whitish and red pronotum with its acuminate posterior process. In an orderly arrangement of the genus it perhaps finds its place near *fuliginosus* Emmons, though not so decidedly arcuate, the form of its pronotum, particularly as respects the often decurved apex, closely corresponding in that feature with the figure of that species given by him. But it is a little longer and proportionately lower, with more pronounced anterior sinus, and even brighter colored than the pale forms of that species, and its posterior pronotal process is decidedly slender and acute. Its supra-humeral bands suggest those of *discoidalis* Emmons; but, unlike that species, they do not extend down over the face, and the oblique vitta, though bordered behind at the lateral margin with black, does not extend so far to the rear. Its larger size, reddish posterior half, pale femora and strongly enfumed fore wings also distinguish it. The arch of the crest and attenuate pronotal apex recall *fenestratus*; but here again it is much larger, the arch between the carinal sinuses is not so abrupt, the mid-dorsal translucent spot is only slightly pellucid, the pronotal apex is usually definitely deflexed, and the strongly enfumed fore wings with their broad apical cloud are divergent characters. Figures of both sexes are herewith presented, and their description follows:

***Cyrtolobus acuminatus*, new species.** (Plate VI, Figs. 47, 48.)

**FEMALE:** In size rather above the average; colors contrasting, creamy white anteriorly, red posteriorly; arch pronounced between anterior and posterior sinuses, apex of posterior process attenuate, usually decurved, no anteapical vitta, clypeus plainly produced, fore wings strongly enfumed.



Face creamy, shining, small punctures reddish brown, clustered adjacent to eyes and on front, spots at base above ocelli elongate vertical; clypeus with sutures strong, loræ outlined with reddish without and within, clypeus centrally strongly produced below line of cheeks at least as far again as length of loræ, seemingly variable in width, tending to comparatively narrow, very little incurved.

Pronotum rising vertically in plane of face about twice as high as is middle of post-humeral sinus, thence rounded back almost horizontally to above humeral angles, where it begins a pronounced arch to posterior sinus. its highest point before middle. From the latter sinus the posterior process is attenuate, prolonged, very sharp at its apex and usually, but not always, rather strongly deflexed, attaining or exceeding apex of terminal areole of fore wings. Punctures of surface back of oblique vitta are large and deep, the surface reticulate. Metopidium and pronotum anterior to oblique vitta creamy white, with narrow reddish brown bands arising at black or red callosities above eyes and surpassing humeri, but more or less lost thereafter. Oblique vitta rising from lateral margin just back of mid-dorsal translucent spot to a point a little anterior to that spot, its rear margin surpassing its base, thence horizontally forward to above posthumeral sinus, where its rear margin often turns abruptly to carina, its front margin reaching carina at anterior sinus. The anterior margin of this vitta is very poorly defined, except at the lateral margin of the pronotum, by reddish punctures much interrupted by the cream colored surface of the forward parts. The vitta itself is cream colored, extends narrowly forward along lateral margin, and is bordered behind by the red of the posterior surface of the pronotum, along its lower half by darker red tending to blackish. The crest is very narrowly thinned back of anterior sinus and along posterior sinus, with a strong mid-dorsal compression containing a deeper than wide pellucid spot, on either side of which the carina is narrowly blackened. The anteapical vitta is lacking.

Body beneath black anteriorly, abdominal segments pale testaceous, the ninth bordering the ovipositor washed with red.

Fore wings sub-hyaline, strongly enfumed, the corium dark red to black, apex a little more intensely infuscated, covering terminal areole and half of adjacent cells, the anterior margin of cloud indefinite.

Legs pale testaceous, including femora.

Length 6.50 mm.

**MALE:** Like the female, but much smaller; in the allotype the clypeus is narrow and even more produced, exceeding the loræ by about twice their length, and is very hairy at its tip. Supra-humeral bands faint; posterior process of pronotum attenuate and very sharp, but not at all deflexed, attaining middle of terminal areole of fore wings. In a specimen cited below, whose coloring may prove to be the prevailing one, the cream and red of the pronotum are largely supplanted by black, with the pronotal apex white.

Body beneath, legs and fore wings as in female.  
Length 5.60 mm.

Holotype ♀. Pine Island N. Y. VI/19/'12 (W. T. Davis), in Davis collection.

Allotype ♂. Taken with holotype. In my collection.

Paratypes: Four females, taken with types, and a male and five females taken in northern New Jersey (E. L. Dickerson) in Coll. Am. Mus. Nat. Hist.

A male at hand from Berkley Heights, N. J. (VI/9/—), resembles in coloring, but not in form, the male of *muticus* Fab. in the sub-genus *Xantholobus*. Its face, base of metopidium, and shoulders are yellowish white, with black on front of metopidium from a little above base, filling in space between humeral bands, which are obliterated, and area between narrow pale lateral margin and oblique vitta, and also back of that vitta to posterior sinus, replacing red of allotype. Its posterior process is wholly creamy white, and its fore wings are clearer, though somewhat enfumed.

Thus far I have seen examples of this species from New York and New Jersey only, twelve in all. But that should not necessarily be taken to mean that it is rare; more likely that it is extremely local in its distribution. The female holotype is perhaps a little below the average in length, one specimen before me measuring 7.10 millimeters; and the posterior process of the pronotum is usually decidedly decurved, much more so than is shown in the figure given herewith. Its size and general color and pattern at once suggested to me Fairmaire's description of *sculptus*, ever present in my mind; but the absence of "two almost transparent dorsal spots" and its strongly enfumed fore wings bar it from that identification.

This species well exemplifies what seems to be the very plastic state of this genus, with the consequent difficulty in finding structural characters that in themselves will serve definitely to fix a species; for instance the clypeus of the female, here usually long, narrow and much protruded below line of cheeks, is in one specimen comparatively broad and but little protruded. And the degree of deflexion of the pronotal process from zero to extreme is another instance. The comparatively large size, creamy white

forward parts, and general facies, all serve to mark it out as distinct from other described species.

*Cyrtolobus dixianus* new species.

The following species, not heretofore recognized, in the female suggests *arcuatus* Emm., with which I have found it associated on its host plant, but it is at once distinguishable in the field by its green rather than grayish or testaceous color, and more particularly by its more moderate pronotal arch without apical sinus, and by the entire lack of the broad white anteapical vitta with its anterior reddish brown border, more or less pronounced in that species. The male is wholly dissimilar. Descriptions and figures of both sexes are herewith presented.

*Cyrtolobus dixianus*, new species. (Plate I, Figs. 5, 6.)

FEMALE: Much the form of *arcuatus* Emmons, but a little smaller. The acute posterior process of its pronotum, while reaching at least to apex of terminal areole, does not attain the apex of the fore wings as in that species. Color light green throughout; some specimens in life more or less washed with bright yellow, particularly on face and metopidium centrally and over humeri, and on sides of abdomen. As usual with green insects, this color often undergoes a change in drying specimens, becoming on the pronotum a tan shade which more or less completely, though rarely entirely, usurps the original green, and on the face and softer parts tends toward a pale yellow.

Face between eyes but little broader than long, margins of genae strongly sinuate, again incurving to the distinct clypeal sutures, their outline therefore not continuous with that of clypeus; the latter very slightly inflexed, moderately produced and rounded. Eyes green, centrally reddish brown.

Pronotum moderately arched, highest just before middle, carina curving evenly without sinuses to apex, where it meets the rectilinear side margins undeflexed; the whole crest bright green, flecked with small pale green or white impunctate spots becoming creamy white in dried specimens. and covered inconspicuously with fine, erect and sparsely placed hairs. Punctuation not very coarse, punctures regular in size, evenly and fairly densely distributed.

Body beneath green.

Fore wings hyaline, their veins greenish and distinct; apex immaculate.

Legs green, claws rosy.

Length 7.5 mm.

MALE: Form similar to that of female, but arch much less pronounced; punctuation coarser and sparser, and surface consequently more shining.

Face green.

Pronotum anteriorly, including metopidium and forward part of crest, covering humeri and running diagonally to middle of lateral margins. bright green; back of this the crest is creamy white, with brown as follows. A small blotch on carina just forward of middle; a broad band from behind middle of dorsal carina running vertically to lateral margin; and another covering apex—the whole pronotum with the white flecking spots seen in the female.

Body beneath bright green. Tergum of abdomen black, the black in some specimens invading the green of the ventral segments. Genital organs black.

Fore wings hyaline without fuscous apical cloud, as in female; brownish coriaceous at extreme base.

Legs bright green.

Length 6.5 mm.

Holotype ♀. Hazen, Ala. IV/9/'21. Taken on *Quercus minor*.

Allotype ♂. Same locality, date and host plant. Both in my collection.

Paratypes: Nineteen males and thirty-eight females. Same locality.

The holotype and allotype were taken by me *in copula* by beating *Quercus minor*. Five of the paratypes were beaten from *Quercus phellos*, the rest from *Quercus minor*, the latter evidently the preferred host plant. In the National Museum collection is a female specimen from Maryland, in Dr. Funkhouser's collection one from Rochester, N. Y., which seem to be this species. and in Mrs. Slosson's collection is a pair taken in copulation at Delaware Water Gap, Pa. In Alabama I have found this species in comparative abundance on its host plant (*supra*) from April 5 to 13, 1921, and April 23 to May 4, 1923; and many more females might have been captured easily. Not so with the males, however. That sex was the most agile *Cyrtolobus* I have ever endeavored to cover with my hand in the inverted umbrella; and for several days upon first encountering them I despaired of securing a single specimen, as they took to flight almost instantaneously upon touching its surface. In 1923 they proved to be much less abundant in the type locality than in 1921; but the season was unusually late and cold, which doubtless accounts for their scarcity in that year

*Cyrtolobus celsus* Van Duzee.

*Cyrtolobus celsus* Van Duzee belongs to the strongly arcuated group in the genus, and was described by Van Duzee in his "Studies" under Fitch's name *fenestratus*, as subsequently pointed out by him. It was founded upon three females, one from Georgia, another from Massachusetts, and the third from Staten Island, N. Y. The latter is now before me. In my judgment the northern examples are specifically separable from those of the south, and of the three examples above mentioned that from Atlanta, Ga., should alone be regarded as the type of *celsus*. The structural characters which seem to me most distinctive are an extreme hairiness, the pronotal arcuation high above humeri, not retreating or with suggestion of anterior carinal sinus, a pronotal swelling back of upper part of anterior vitta and another before the posterior vitta, present in both sexes but in varying degree, with the mid-dorsal compression anterior to the latter a deep rounded pit. It seems to be far from common, and comparatively few undoubted males have been noted; none taken in copulation. As that sex has not been described, a characterization is here presented, based upon a specimen taken this past season in Alabama in a locality in which females were also taken.

*Cyrtolobus celsus* Van Duzee. (Plate II, Fig. 9)

MALE: Shining, hairy, more densely on face and metopidium. Pronotum evenly arched from base to summit before mid-dorsal translucent spot, its outline on metopidium exceeding plane of face, sinuate at translucent spot and anteapical vitta, barely attaining basal angle of terminal areole of fore wings.

Face mottled brownish testaceous, with inner margins of loræ dark brown.

Metopidium similarly colored, vague brownish bands from basal callosities above eyes running over humeri, punctures black. Coarse punctures of pronotum thickly interspersed with fine setæ-bearing punctures, the hairs three to four times as long as the diameter of the coarse punctures; compressions at anterior, mid-dorsal and anteapical pale spots strong and deep, the pronotum conspicuously swollen between them on either side of the mid-dorsal translucent spot. Oblique anterior vitta arising from middle of lateral margin, directed toward but not quite reaching base of mid-dorsal translucent spot, thence vaguely forward to above post-humeral sinus where it turns abruptly and broadly upward to dorsal carina. This vitta is broadly bordered posteriorly with dark brown, back of which the

pronotum is an umber brown, with narrow and deep white mid-dorsal translucent spot and vertical anteapical vitta.

Body beneath black, abdominal segments pale.

Fore wings hyaline, a dark fuscous cloud on terminal boarder encroaching on apical areoles.

Legs pale testaceous, femora above black.

Length 5 mm.

Allotype ♂. Hazen, Ala. V/4/'23. In my collection. Taken on *Quercus minor*.

A male specimen in the Funkhouser collection, taken at Southern Pines, N. C., corresponds with the above described allotype except that its coloring is prevailingly dull reddish. A female taken at Lakehurst, N. J., a region noted for the southern aspect of its fauna, is the most northern record I have seen for this species. In general it is of medium size, has a rather chunky appearance, with the high arch of the pronotum particularly full in front, and its surface characterized by unusually long and abundant setæ more or less erect, but confused in direction by the abrupt and irregular undulations of its tuberosous surface. *C. clarus*, described in this paper, is also recalled by the deep and narrow mid-dorsal translucent spot; but in this species, as already pointed out, the pronotal arch is devoid of any suggestion of anterior sinus, is more roughly reticulate on the sides in the female, lacks the extended and deflexed pronotal apex of *clarus*, and is characterized by the posterior tuberosity of the pronotum above referred to. A figure of a female of this species is appended hereto on Plate II, Fig. 10; and the northern form so frequently confused with it is next considered.

*Cyrtolobus funkhouseri* new species.

The females of the following new species have a strong superficial likeness to those of *C. celsus* Van D., with which they are commonly confused. They particularly resemble that species in size, general form of the pronotum, and somewhat in detail; so that upon a more or less casual examination they would be ranged together. Indeed it was not till the evidently diverging characters of the males were noted, precluding their association, that those of the females, largely comparative though they be, were recognized as amply sufficient to distinguish them from *celsus*.

Briefly, the absence of the long, dense, erect hairiness of the pronotum is in itself adequate for the separation of this species from *celsus*; and from *vanduzeei*, which it also closely resembles, it is at once distinguished by the abruptly incurved clypeus, not protruding conspicuously below the line of the cheeks in frontal view as in that species and in *celsus*, as well as by its somewhat smaller size. The following detailed description of the two sexes will serve to indicate other points of divergence.

**Cyrtolobus funkhouseri**, new species. (Plate II, Figs. 11, 12.)

FEMALE: Medium in size, moderately hairy, hairs short, punctures of pronotum shallow, surface smooth, somewhat shining. Color dingy reddish brown, paler anteriorly, with usual vittæ and pellucid spots.

Face creamy white, smooth, sparsely and finely punctured with light reddish brown, more densely next to the eyes, much broader than long, the line of the cheeks continued by clypeus, which in front view is not produced below them, and in side view is seen to be strongly reflexed.

Pronotum with metopidium pale brown more or less mixed with cream, darker reddish brown bands rising from callosities above eyes to summit, but not passing over humeri; anterior oblique vitta creamy, back of which the pronotum is a darker reddish brown interrupted by mid-dorsal translucent spot and anteapical vitta. Punctures of metopidium twice as large as those of face, about half as large as those of pronotum back of humeri. Erect hairs of face and pronotum not twice as long as diameter of the large shallow punctures of sides of pronotum. Arch rather high, usually slightly retreating over humeri to a slight sinus indicated on carina before humeri and anterior to crossing of oblique vitta, and thence rising and arching evenly to posterior apex, with more rarely a slight sinus at crossing of anteapical vitta; its posterior process reaching to middle of terminal areole of fore wings. The anterior oblique vitta runs from above humeri back almost horizontally to a junction with the elongated mid-dorsal spot, and thence abruptly but obliquely down to lateral margin, reaching it, somewhat expanded, well back of posterior margin of mid-dorsal spot, and thence it runs forward narrowly along margin to base exterior to eye. Anteapical vitta vertical, broad, expanding on dorsal carina. Mid-dorsal translucent spot conspicuous, longer than wide, compression wide and deep; crest also compressed at crossing of carina by anterior oblique and anteapical vittæ, somewhat bulbous between the three compressions but not so much so as in *celsus*.

Body beneath testaceous.

Fore wings hyaline, washed with flavous, coriaceous at extreme base with usual punctures, tip slightly cloudy with apical cells a little invaded.

Legs testaceous.

Length 5.50 mm.

MALE: Like the female, smaller, strongly shining, red (in allotype and other examples) or black, the broad bands above callosities of metopidium continued over humeri to fill space between lateral margin and oblique anterior vitta; carina at base marked with blotch of red or black, which is repeated immediately anterior to the crossing of the oblique vitta. The pale vittæ and markings are whiter and more clearly defined than in the female, the deep mid-dorsal translucent spot apparently continued to pronotal margin by its junction with the inferior half of the abruptly deflexed oblique vitta, these markings having the effect of white bridle-reins and girth on the dark insect.

Body beneath black.

Fore wings hyaline, clearer than in female, with darker narrow terminal cloud.

Legs testaceous, femora above black.

Length 5. mm.

Holotype ♀. Litchfield, Conn. VI/30/'23. In my collection. Taken on *Quercus rubra*.

Allotype ♂. Yaphank, Long Island, N. Y. VI/15/'23. In my collection. Taken on *Quercus coccinea*.

Paratypes: A male and two females, Central Park, L. I., N. Y., and females from Litchfield, Conn., and Delaware Water Gap, Pa., in my collection; two males from Canada and one from Indiana in Nat. Mus. coll. A male from Lexington, Mass., and a female from Bedford, Mass., in Funkhouser collection; a male from Yaphank, N. Y., and females from Massapequa, Long Island, and Staten Island, N. Y. in Davis collection; and a male and two females from Bay Shore, Long Island, and four females from Yaphank, Long Island, N. Y. in Olsen collection, and one from Summit, N. J. (Dickerson) in Am. Mus. Nat. Hist. coll.

This species, in spite of its generally close resemblance to *celsus* in the female, is quite easily separated from it by two of the characters above pointed out, to-wit, the erect hairs of the pronotum, in this species not long nor very dense, those over the humeri less in length than twice the diameter of the lateral punctures of the pronotum, while in *celsus* their density is conspicuous and in length they exceed the diameter of the larger pronotal punctures from three to four times; and the other character is the clypeus, which is short, not exceeding line of cheeks, but abruptly incurved, whereas in *celsus* it plainly protrudes below the line of cheeks and is hardly at all incurved. Other differences are in the shallower pronotal punctures of this species, and its comparatively smooth surface, contrasting with the deeper punctures and



almost reticulate surface of *celsus*, the less forward arching of the pronotum here, with an anterior sinus usually indicated, while in that species there is rarely a suggestion of sinus; nor are the compressions at the pale spots of the crest, though marked, so deep as in that species, with its consequent greater bulbosity of the pronotum before and behind the mid-dorsal translucent spot. Furthermore, the oblique vitta in *celsus* meets the lateral margin further forward than here, rarely further back than the hind margin of mid-dorsal translucent spot; and again the fore wings of *celsus* are a much clearer hyaline. In the male the almost smooth and shining surface of pronotum without the strong swellings, and the much sharper definition of pattern, will serve to distinguish it from that sex of *celsus*, the vittæ being broad and clear, and together with the mid-dorsal spot often equalling the dark area of the rest of the pronotum.

An examination of the Staten Island example of the three specimens upon which *celsus* was founded shows it to belong here, as doubtless does the specimen from Massachusetts cited in its description; in fact, all specimens of this species which I have seen were taken in the north, while *celsus* seems to be primarily a southern species. The preferred host plant is not known, at least four species of oak having been found to harbor it.

*Cyrtolobus vandusei* Goding.

This is a southwestern and Pacific coast species found in great abundance on the western live oak, and as at present understood is subject to great variation in form and color, especially remarkable in the males. From my experience with other members of this admittedly variable genus the suspicion presents itself that there may be confusion here; and it is recommended that the guests of that host be carefully studied with particular attention given to the mating of the several forms, and that the results of that study be published.

*Cyrtolobus clarus* new species.

The following is a distinct species hitherto undescribed, and, so far as known at present, occurs only in our southern states. In Alabama I have found it one of the earliest species to reach

maturity, and the females at least to be fairly abundant. Figures of both sexes accompany this paper, and their description follows:

*Cyrtolobus clarus*, new species. (Plate II, Figs. 15, 16.)

A medium sized species, strongly recalling in form *C. fenestratus* Fitch, but with pronotum grayish rather than red, higher posteriorly at carinal sinus, and less attenuately produced apically.

**FEMALE:** Face between eyes about as broad as long, testaceous, punctures blackish at inner margins of eyes and outer margins of genæ and loræ. Clypeus narrowly produced, its sutures blackish, distinct. Ocelli much nearer to each other than to the eyes.

Pronotum granulate-punctate, little elevated arching between white anterior and posterior sinuses, thence prolonged in an acute apex which almost reaches that of fore wings. Metopidium at base between and including callosities narrowly brick red. On either side of the dark brown carina it is pale brown or testaceous. Externally of and next to this a very dark brown, or in some specimens reddish, narrow band rises from basal red margin over humeri to a point below anterior carinal sinus, where it abruptly terminates. Beyond the dark band and covering humerus to above post-humeral sinus the surface is yellowish testaceous, through the middle of which runs an obscure reddish band. Anterior oblique vitta white, slightly angled at its middle, runs from anterior carinal sinus to pronotal margin two-fifths from humerus, where sometimes it is slightly expanded forward; and the anteapical vitta runs from posterior sinus directed forward to margin two-fifths from apex. The anterior vitta is bordered in front, at least on its lower half, by a narrow reddish brown line, and in the rear by a black line sometimes as broad as itself. Between these vittæ at dorsal compression is a rectangular deeper than wide translucent spot on a reddish ground color, which latter likewise covers apex.

Body beneath flavo-testaceous.

Fore wings hyaline, with a slight flavescent wash; tips with moderate infuscation, encroaching on terminal areole.

Legs yellowish testaceous.

Length 5.60 mm.

**MALE:** In form and pattern like the female, but a little smaller; the dark punctures on the ground color giving it a more decided grayish effect.

Face testaceous yellow, coarsely and closely covered with black punctures. Eyes dark brown.

Pronotum reaching to a point vertically above base of terminal areole of fore wings. Anteriorly it is dark brown, testaceous toward humeri, coarsely granulate-punctate with brown and black punctures, giving it an irrorate grayish appearance, the dark punctures somewhat obscuring the anterior oblique white vitta. The reddish of the remaining surface in the

female is replaced by brownish black, the mid-dorsal squarish translucent spot and anteapical vitta distinct.

Body beneath black, genital segments flavescent, organs black at tip.

Fore wings clear hyaline, veins flavescent, tips margined narrowly with fuscous.

Legs pale.

Length 4.75 mm.

Holotype ♀. Hazen, Ala. IV/4/'21. In my collection.

Allotype ♂. Same locality and date. Also in my collection.

Paratypes: Seven males and forty-two females. Same locality IV/4-20/'21, & '23.

The holotype and allotype were taken on *Quercus digitata*, and the paratypes on *Q. prinus*, *rubra*, *digitata* and *minor* growing in a row along a road. No pair was taken certainly in copulation, though one pair was knocked off together; but they were taken from the same trees at the same time (the males only about one to six females), and the general form and pattern of these males shows such marked similarity to that of the females, that I feel no hesitation in holding them to belong to the same species.

In addition to those taken by me in Alabama, I have seen a female specimen from Orlando, Fla., in the Funkhouser collection, and a large series of both sexes from Louisiana in the Baker collection at the United States National Museum.

The bands over humeri suggest *C. discoidalis* Emmons, but in this species they are usually much less extended, and there is a third dark band between them, more or less developed and covering the metopidian carina. Perhaps its most characteristic mark is the (usually) narrow and deep mid-dorsal translucent spot. It is at once distinguished from both *fenestratus* and *discoidalis* by the conspicuously granulate appearance of the metopidium and pronotum in general, by the point of incidence (or origin) of the anterior oblique vitta on the lateral margin, being here well forward of the middle, and by the presence of the broad apical vitta, which here extends undiminished to the lateral margin. Inasmuch as no undoubted specimen of Say's widespread species *vau* has been seen by me from this locality, and on the possible supposition that this might be a form of that species, I have compared the two, and it is apparent that there can be no confusion between them. They are plainly distinct. From *vau*

it is distinguished by the greater arcuation of the pronotum and its much more pronounced apical sinus, by the greater production of the pronotal apex, which in *vau* barely reaches as far caudad as the basal angle of the terminal areole of the fore wings, the narrower than deep mid-dorsal translucent spot, the irregular posterior black border of oblique vitta, and the presence on the fore wings in the female of a terminal cloud. It also lacks the almost rectilinear lines which in *vau* usually characterize its pronotal carina from summit immediately back of the incidence of the anterior vitta percurrently to apex, and also in the posterior border of that vitta.

*Cyrtolobus fenestratus* Fitch.

The types of the female and male of this species are in the State Museum at Albany, N. Y., so no doubt can be entertained as to the identity of the insect upon which Dr. Fitch founded this genus under the preoccupied name *Cyrtosia*, for which Dr. Godding substituted its present name. Unfortunately, Mr. Van Duzee had not examined them at the time of the publication of his "Studies" (ante), so the reference to this species in that paper is erroneous, as subsequently pointed out by him (Can. Ent. 1909, p. 383). It is, in life, one of the most beautiful species in the genus, both in color and grace of outline. The female has a bright green head and body, which in the dried specimen becomes yellowish, and exhibits conspicuously the squarish window in the keel of the pronotum, the latter red, very slender, and tapering to the long, acute apex, which attains the apex of the fore wings with their narrowly but strongly clouded terminal margins. The males are by no means always black, as described, reddish ones with whitish testaceous vittæ occurring commonly. For aid in identifying males of this species, I present herewith on Plate VI, Fig. 43, a figure of a specimen of that sex; and in Fig. 44 one of a female also.

*Cyrtolobus tuberosus* Fairmaire.

The male of this species, while smaller and somewhat darker than the female which is generally recognized, closely parallels that sex in its coloring and markings, particularly as respects the

broad, elongate mid-dorsal translucent spot, which curves forward at the mid-dorsal compression to meet the anterior oblique vitta at about its middle. It is found on almost any species of large oak, and is one of the most abundant and best known species in the genus, presenting no difficulty in its identification. Florida examples seen by me are paler and pinker than those found in the north, but are otherwise typical.

*Cyrtolobus grandis* Van Duzee.

This rather large species has a crest somewhat like, though lower than, that of *C. tuberosus* Fairm., and is notable for the long and slender apical process of its pronotum. Its habitat is in our southwest.

*Cyrtolobus discoidalis* Emmons.

Considerable confusion seems to prevail respecting the identity of *Cyrtolobus discoidalis* Emmons, and I am by no means satisfied that the species usually passing for it in collections should bear that name. Van Duzee, with admitted hesitation, recognized in the "Studies" three specimens possessing shoulder bands as being probably examples of the species inadequately described under this name. One of them, a female in the Cornell University collection, seems to have been the basis of his more detailed description, at least it agrees closely with it, in which he notices the lack of correspondence between its oblique vittæ and those represented in the figure given by Emmons. Other discrepancies are to be noted. For instance, in the species represented by the Cornell example the anteapical vitta is obsolete and often entirely lacking, whereas Emmons describes and figures that vitta as plainly marked, though apparently dull in color. The figure in outline also shows the pronotal apex exceeding the terminal cells of the fore wings and almost attaining their apex, an extension of the pronotum which I have not seen closely approached by any specimen of this species. I might suspect from Emmons's figure that it was drawn from a specimen of *van* Say as here recognized, though in that species the supra-humeral bands are rarely so pronounced as there indicated, and in outline it attains its highest point more forward than shown in his outline drawing. It is

significant that one of Van Duzee's three specimens above referred to, that in the Davis collection from Sparta, N. J., is evidently an example of *van* Say. Nor does Emmons's brief description bar out that species, drawn admittedly from a cabinet specimen, and perhaps somewhat discolored. Nevertheless, his figure is far from typical of *van*, and even though it falls short of fitting the species evidenced by the Cornell specimen, I deem it best for the present to continue to apply to the latter Emmons's name of *discoidalis*; influenced perhaps by the supra-humeral bands, not referred to in his description, and present in many other species in the genus, but well indicated in his drawing, and in this species very conspicuous, sweeping in a rather narrow but pronounced band from near margin of genæ across face at inner edge of eye, up over metopidium and shoulder, thence vaguely back, becoming evanescent over post-humeral sinus, sometimes merging in the dark area immediately anterior to the pale oblique vitta. This vitta is unusually broad at its marginal origin, so that its posterior border is well back of the middle. It is bordered anteriorly with a narrow blackish brown band more or less interrupted at its middle, and posteriorly with a very conspicuous similar dark band rising broadly from lateral margin and becoming attenuate superiorly. The character of this oblique vitta at the lateral margin, broadened and extended far to the rear, and conspicuously bordered in front and behind with dark brown or black, is, with the supra-humeral bands, diagnostic. Briefly characterizing it further, it is, in the female, a medium-sized yellowish testaceous species with dark irregular lines streaming rearward, the pronotum arching moderately with a rather obscurely pellucid mid-dorsal compression, a pale spot at position of anteapical sinus, which is otherwise hardly indicated, the anteapical vitta obsolete, and pronotal tip not attaining apex of fore wings, which are strongly enfumed, their terminal areoles broadly infuscated. The male seems never to have been described. Several examples have been taken by me, two with females in copulation. A figure of one of these, the description of which follows, as well as a figure of a female, accompany this paper.

**Cyrtolobus discoidalis** Emmons. (Plate VI, Figs. 45, 46.)

MALE: In general like the female, but a little smaller.

Face pinkish testaceous; clypeus hardly produced.

Pronotal margin from base above eye over humeri to junction with lateral origin of oblique vitta broadly whitish testaceous. Dark brown supra-humeral bands extending broadly rearward, filling in the space between testaceous margin and oblique vitta, the latter arising from lateral margin far to the rear, and bordered with black as in the female. Pronotum otherwise reddish testaceous, becoming darker red between oblique and broad white anteapical vittæ, the latter curving slightly forward and almost meeting origin of anterior vitta on lateral margin. Back of posterior vitta black. Mid-dorsal pellucid spot squarish and pronounced.

Body beneath black.

Fore wings slightly enfumed, broadly dark fuscous at apex.

Legs pale, femora above black, polished.

Length 5.65 mm.

Allotype ♂. Litchfield, Conn. VI/23/'20, in my collection. Taken on *Quercus rubra*, in copulation with female.

As is not uncommon with males in this genus, many are found with the pronotum wholly black or dark red except for the whitish anterior lateral margin, oblique and anteapical vittæ, and pellucid mid-dorsal spot. Is these, where the humeral bands are merged in the ground color, the position and shape of the marginal origin of the anterior oblique vitta proves the most useful diagnostic mark.

*Cyrtolobus aureus* new species.

The following is a rather scarce species, judging from the paucity of examples thus far discovered; but it is one of the loveliest in coloring, particularly in the female, where in life clear green and pink are charmingly contrasted. It is a little above the average in size, and easily distinguished in that sex by the unusual character of the pronotal markings, which radiate from the lateral margin in widening streamers of alternate pale green and rose—whence the chosen name. It may be described as follows:

*Cyrtolobus aureus*, new species. (Plate I, Figs. 7, 8.)

FEMALE: Face yellowish green, one-quarter to one-third broader than long, eyes rose. Clypeus hardly produced; sutures distinct.

Pronotum strongly elevated, evenly arched, highest a little forward of middle, punctuation very fine and irregular. The usual anterior sinus

between metopidium and superior arch of crest slight but evident, posterior sinus almost obsolete; apical process not at all deflexed, with a rather blunt aspect due to the lateral margin rising slightly to apex, the latter reaching, in the type, to an imaginary line erected vertically at apex of terminal areole of fore wings, in most specimens at hand barely reaching as far posteriorly as the basal angle of the areole. Color pale green and rose, as follows: Metopidium and humeri a bright light green. A broad rose band beginning on crest just back of anterior sinus, and expanding obliquely downward, reaches lateral margin at rear of post-humeral sinus, and extends along that margin to its middle. Back of this is a broader vertical green band, somewhat triangular in shape, narrowed below by encroachment of anterior rose band, and reaching lateral margin. This is followed by a second rose band descending straight to margin, another green band only one-third as wide from position of posterior sinus to lateral margin, and back of that is rose again, covering pronotal apex.

Body beneath light green; ovipositor deep rose.

Fore wings hyaline, immaculate, their terminal margins and posterior half of veins washed with rose, the anterior half light green.

Legs flavous, tarsi apically rose.

Length 6.50 mm.

MALE: Pronotum arching similarly to female, but much lower; somewhat shining, punctuation much coarser. Color black and yellowish testaceous.

Face black, margins and front deep rose.

Pronotum black, with basal margin of metopidium, humeri and post-humeral sinus narrowly outlined with deep rose. Crest black, a narrow irregular testaceous band from just back of middle to lateral margin, slightly inclined rearward in descent, the lower half of pronotum between this band and post-humeral sinus dark reddish, and a testaceous vertical band from posterior sinus of pronotal carina to lateral margin, corresponding to the apical green band of the female. Apex dark rose.

Body beneath black, ventral segments deep yellowish testaceous.

Fore wings sub-hyaline, washed with fuscous, the apical margin darker, but not maculate.

Legs yellowish testaceous.

Length 5.75 mm.

Holotype ♀. Litchfield, Conn. VI/16/'22. Taken on *Quercus alba*. Allotype ♂. Same locality, date and host plant. Both in my collection.

Paratypes: Two males and seven females. Litchfield, Conn. All on *Quercus alba*. Also in my collection.

The holotype and allotype were taken by me *in copula*, the pronotum of the male being somewhat deformed and twisted at its apex.



This species, of an unusual pattern in the genus, seems to be rare. The only specimens I have seen, other than the few taken at the type locality, are a female taken at Newark, N. J., and a female and two males taken at Berkley Heights, N. J. (E. L. Dickerson), in the collection of the American Museum of Natural History, New York, two males taken at Pine Island, N. Y., and at Yaphank, Long Island, N. Y., in Mr. Davis's collection, two males taken at Rochester Junction, N. Y., in Dr. Funkhouser's collection, a female with a "N. J." label in that of the National Museum, and what appears to be a male of this species in the same collection, taken at Chicopee, Mass.; also a female in Mrs. Slosson's collection taken by her at Delaware Water Gap, Pa. Figures of the holotype and allotype are herewith presented, the outline of the deformed pronotal apex of the male corrected in the drawing to conform with that of another specimen.

*Cyrtolobus cinctus* Van Duzee.

This species is not represented in any collection to which I have had access except possibly that of Dr. Funkhouser with a non-typical female lacking the lateral black arcuate line, taken at Ithaca, N. Y., the type locality, and that of Cornell University, which contains the type female, as well as the supposititious male. The latter has been submitted to me through the courtesy of Dr. Bradley of that university, and is in my opinion undoubtedly a male of *C. fuliginosus* Emmons. In my own collection is a female taken by me at Bronxville, N. Y., which is apparently of this species. I have critically compared it with the type, with which it agrees except that the so-called anterior vitta of the original description, an arcuate narrow black line, in my specimen has its origin on the lateral margin of the pronotum further forward, over post-humeral sinus, rises vertically about half way, and then curves forward and upward to dorsal carina. Back of the upper half of this line the green pronotum of this specimen is somewhat stained with brown. Notwithstanding these differences, I believe this female and the above type specimen are of the one species. Standing side by side, it seems impossible to separate them specifically. It might be pointed out that in this genus the vittæ are pale when apparent at all, and therefore the black line in the type, although occupying a position corresponding

to that of an anterior oblique vitta, is not necessarily to be regarded as that vitta. Accordingly the more forward position of that black line in the Bronxville specimen may be significant of a variation of pattern rather than a displacement of so characteristic, though far from invariable, generic mark as the vitta in question. The capture of further examples of this species is greatly to be desired, particularly that of an undoubted male taken *in copula*.

*Cyrtolobus vau* Say and *sculptus* Fairmaire.

The first species assignable to this genus to be recorded from this country was taken in Pennsylvania, and was described by Thomas Say in 1831 under the name *Membracis vau*. Although the genus as now recognized and delimited to which the species as described by him belongs (*Cyrtolobus*) contains in this country many other distinct species, many of which are fairly abundant in those parts of the United States in which Say collected, it is a significant fact that, except for *C. inornata*, he never described another species assignable to it. The significance lies in its bearing on the question as to just which one of these many species we are to recognize as *vau* Say. As is well known, practically all of his types have been destroyed, including those in this family; so we are thrown back on his description, given in considerable detail, and, to supplement that, such collateral and inferential evidence as may be available. In the first place it became evident that there was no concord of opinion as to its identity, almost every collection to which I have had access having different species standing under the name *vau* Say, most of the species so assigned presumably having been found to agree substantially with the original description. That this should be true is not at all strange, as there is a prevailing type of pattern in the genus, well indicated in that description, which, while not universal, is found in a large number of distinct species, and the dimension given by Say—one-fourth inch in length—has very reasonably, though erroneously, been regarded as a general approximation. As other students had done, so I attempted to determine from material of my own collecting, irrespective of other determinations, whether any of it might be placed under that name with a colorable title to it. One species seemed preeminently to

display the requisites of Say's description, and the considerable material from our northeastern states and Canada representing this species in my collection included specimens from the state which Say said *van* "inhabits"—Pennsylvania. But this species I had already determined as Fairmaire's *sculptus*, both from the original description and from that contained in Van Duzee's "Studies" (ante). Specimens thus labelled *sculptus* Fairm. were then sent to Dr. Funkhouser for confirmation, and promptly returned with his identification of them as *van* Say. Notwithstanding their accord with Say's description, and the conspicuous approach in the female (the sex now under consideration) of the anterior oblique and posterior vittæ at the lateral pronotal margin, forming the character V which Dr. Funkhouser pointed out was very likely what Say intended to indicate by his specific name, the specimens in question in my opinion were undoubtedly *sculptus*, Fairm., so remarkably well did they conform to his description. In this predicament resort was now had to the examination of specimens which our entomologists of earlier generations had recognized as of this species; and learning that the Thaddeus Harris collection in the museum of the Boston Society of Natural History contained examples purporting to be *van* Say, I next examined that. Dr. Harris was a contemporary and friend of Say, so my hopes of resolving the difficulty were high. The collection contained two specimens bearing the number 224♀, one of which also bore a label with the letter U in red ink. Turning to Harris's original Catalogue, the first entry of which, in what is evidently his own handwriting, is "This book was begun in 1822", the following appears on page 1 in red ink in the same handwriting:

"Note. Insects underlined with red ink have had their names confirmed by Mr. Say; and the names and observations in red ink are those sent to me by Mr. Say, after he had examined the collection which I sent to him in November, 1833. To the uniques sent to Mr. Say are added the letter U."

Turning over the pages of this Catalogue to the heading "Index Hemipt, Section Omopt", and running down the numbers, one comes to "224 *Membracis van* S Mss. *Membracis*? June 15, 1832. Camb. June 15, 1835". The words above, *Membracis van* S., are in red ink. So it is apparent that in November, 1833,

Harris sent to Say the specimen bearing the red ink label U, collected June 15, 1832, and that Say returned it with the name "*Membracis vau*", which Harris entered in his Catalogue in red ink, so indicating its identification by Say. At first sight that would seem conclusively to establish the identity of *vau*,—this unique Harris specimen determined by the describer himself as identical with his *vau*. But the specimen does not well accord with the original description! It does not fit it! It has no transverse line near the tip, which much exceeds the end of the nervures of the hemelytra. Could Say himself have made a misidentification of his own species? Why not? At that time *vau* was the only species yet recognized and described which is assignable to this genus. What more natural than that Say should recognize the generic relationship and assume Harris's specimen to be identical with the sole species known—possibly regarding the differing form and pattern as constituting but a variant of that species? For many years and by many students this species has been regarded as subject to great variation, Dr. Fitch for instance, in 1851, briefly indicating ten different varieties of *vau*, eight of which later study has shown to represent two other subsequently described species.

And what did Dr. Fitch himself recognize as typical *vau* Say? Not the species represented in the Harris collection and so determined by Say, but that species which Van Duzee in his "Studies" seems to have regarded as *sculptus* Fm. This specimen is still in the Albany "Cabinet", with Dr. Fitch's printed label No. 658 on its pin, as indicated in his published record,<sup>1</sup> and though somewhat faded is clearly recognizable. And this specimen does agree with Say's description of *vau*! It would be interesting to learn how Dr. Fitch arrived at his determination; but however arrived at, I have no doubt it is correct.

As is well known, a part of Dr. Fitch's material was acquired by the National Museum, and included in that is a much less faded example of this species, a female, bearing on its pin what I was advised at the Museum was Dr. Fitch's large black bordered label with the inscription "*Thelia vau* Say, New York,

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<sup>1</sup> Cat. Homop. Insects State Cabinet Nat. Hist., 4th Ann. Rept. N. Y. Univ. 1851, p. 48.

Ark." Passing over the question as to whether the specimen came from Arkansas, in which State there is at present no place named New York, nor have I seen any other specimen from that section; or from New York State, possibly the Adirondack region, the label is interesting in that it bears, under the words "*vau* Say", and in smaller pen printing, the words "*sculpta* Fairm."! So Dr. Fitch, if that label be his, had come to the conclusion that Fairmaire had before him, when describing *sculpta*, the same species which was before Say when the latter described *vau*. That accords with the conclusion independently arrived at by me. Specimens with the anteapical vitta sub-obsolete, conspicuous only at dorsal carina, are frequently found. The species here determined to be *vau* Say averages about 6.25 mm. in length, and while not quite so long as given in Fairmaire's description, 7 mm., fits it otherwise fairly well; and has long stood as *sculptus* Fairm. in many collections, including my own. No other species known to me accords with that description so well as does *vau* recognized as above. I am not unmindful of the pale form here referred to *fuliginosus* Emmons. In many respects that too answers fairly well to the description of *sculptus*, though the length is still about a millimeter too little. But it is much more than "a little elevated", and a good deal of imagination is required to see the thinner areas on its dorsal margin as "two almost transparent spots", which Fairmaire describes with greater emphasis than is used on the same page in describing them in *tuberosus*, so very conspicuous in that species. With this eliminated, I believe Fairmaire's *sculptus* should be regarded as based upon the same species as Say's *vau*, described in 1831, and if it is, the latter name has fifteen years priority, and Fairmaire's *sculptus* must be placed in the synonymy of *vau*.

Figures of the male and female of this common species in the northeastern United States and Canada are given on Plate I, Figs. 1 and 2, that there may be no confusion as to just what species is here considered.

*Cyrtolobus limus* Van Duzee.

This species is somewhat smaller than *vau* Say as here recognized, with its anterior and posterior vittæ broad and white, and the mid-dorsal translucent spot conspicuous. It was described

from Colorado, and is found in the Rocky Mountain region, commonly on *Quercus gambelli*.

*Cyrtolobus pulchellus* new species.

The following new species is of medium size, with a high, strongly compressed crest, the white markings conspicuous and coloring sharply contrasted. In form and pattern it suggests the little *parvulus* Woodruff (post), but is very much larger, and shows these differences, among others: Lacks the mottled aspect; arch of crest from base of metopidium more retreating; keel but little raised immediately above humeri, slightly sinuate at very prominent anterior white spot, suddenly descending anterior to anteapical vitta; posterior process attenuate; apical cloud of fore wings less squared; femora above pale. Its coloring is about that of *gramatanus* Woodruff (post), but from this it differs in being larger, very much higher, and with a totally different form of pronotum, as well as in lacking the maculation at middle of fore wings, though the veins of the latter in that region are often slightly darkened. Figures of the holotype and allotype are appended, and their description follows:

*Cyrtolobus pulchellus*, new species. (Plate IV, Figs. 29, 30.)

FEMALE: Medium in size, the crest strongly compressed, arching from back of humeri to just before anteapical sinus, the pronotal tip attenuate, and the colors sharply delimited by black.

Face dull testaceous, sometimes yellowish, the sutures distinct, often narrowly marked with rufous or black; clypeus produced beyond line of genæ, little incurved, the genæ strongly sinuate inwardly near eyes.

Pronotal carina curving evenly over slightly retreating metopidium from base to above humeri, thence with slight sinuation at pronounced anterior white spot to summit just before mid-dorsal translucent spot, thence descending gradually to half way between that spot and anteapical vitta, where it develops an abrupt declivity, is sinuate over that vitta and continues to tip of the somewhat extended and attenuate posterior process; the tip of the latter sharp, attaining as far caudad as apex of terminal areole of fore wings, in some specimens attaining only to its basal angle. Metopidium yellowish testaceous, carina black from base to summit, broad strongly arched reddish supra-humeral bands recurved to post-humeral sinus, the humeri yellowish with a reddish blotch on their anterior face, and more or less mottling of rufous and black anterior to the oblique vitta. This vitta is very broad at lateral margin and at carina of pronotum, but

more or less interrupted about the middle, its posterior margin leaving lateral margin of pronotum a little anterior to posterior margin of mid-dorsal translucent spot, directed obliquely forward to below but not reaching lower anterior corner of that spot, thence more arcuately forward to slightly anterior to rear of post-humeral sinus, thence vertically to carina of crest. Mid-dorsal translucent spot broad and deep, conspicuously square, very strongly compressed to its bottom. Anteapical vitta broad at margin, widely expanding forward and rearward till at carina it equals or exceeds width of mid-dorsal translucent spot. All vittæ white broadly margined before and behind with black. Pronotum between vittæ dark red, apex beyond black border of anteapical vitta white, more or less besprinkled with black or rufous.

Body beneath testaceous, ninth abdominal segment in dry holotype and other specimens before me washed with rufous.

Fore wings hyaline, darkly infuscated at base; veins pale, very slightly enfumed at middle; tip with more or less rounded very dark brown cloud covering terminal areole and apical third of cell above it, but not extending up terminal margin above that cell, margin slightly enfumed between apical cloud and pronotal tip.

Legs, including the femora, testaceous.

Length 5.65 mm.

**MALE:** Like the female, but a little lower and much darker.

Pronotum before the anterior oblique vitta washed with blackish red except at middle of base and shoulders; between the vittæ almost black, the compressed crest somewhat bulbous between the squarish mid-dorsal translucent spot and the very broad anteapical vitta; its apex wholly black, or reddish, sharp, but not so produced as is that of female generally, reaching hardly beyond basal angle of terminal areole of fore wings.

Body beneath black, ventral segments testaceous marked with black on sides, middle, and sexual organs.

Legs also as in female, wholly testaceous.

Length 5.40 mm.

Holotype ♀. West Nyack, N. Y. VI/11/20. (C. E. Olsen.) In my collection.

Allotype ♂. Same locality and date and collector. Also in my collection.

Paratypes in collections of Chris. E. Olsen and Am. Mus. Nat. Hist.

Of this distinct species, one of the many denominated *vau* in collections, and for the types of which I am indebted to Mr. Olsen's generosity, I have a considerable series before me. Besides the type locality it has been taken in various places in the northern half of New Jersey. No record of its host plant is at present available.

*Cyrtolobus parvulus* new species.

Among the many forms which have been standing in various collections under the name *vau* of Say is the following distinctive little species, one of the smallest in the group. It bears the usual pronotal pattern, and is perhaps most easily set apart from other similar small species by the jet black upper surface of the femora of the female. Figures of specimens of both sexes are here presented, and their description follows:

***Cyrtolobus parvulus*, new species. (Plate IV, Fig. 31, 32.)**

**FEMALE:** A brown and red species with a rather mottled aspect, having the usual white markings prominent.

Face between eyes a little broader than long, yellowish testaceous, sprinkled with small brown punctures. Clypeal sutures distinct, clypeus a little produced, incurved.

Pronotum coarsely and roughly punctured, including humeri, decidedly elevated, compression of keel beginning below middle of metopidium, pronounced anterior to and above humeri, strongly compressed at mid-dorsal translucent spot, the lower anterior corner of which seems conspicuously sunken by reason of the decidedly tumidous swelling of the crest immediately before it, very evident from a front view. Crest arches from base of metopidium to highest point just back of post-humeral sinus but anterior to mid-dorsal translucent spot, and thence slopes undulatingly, with slight sinuations at mid-dorsal spot and anteapical white vitta, to apex, which exceeds terminal areole of fore wings and attains middle of their terminal border. Metopidium flavo-testaceous, thickly marked with dark brown punctures, congregated so as to form dark brown spots above callosities and over humeri, the latter washed with light brown. In one specimen at hand these punctures are light brown, the dark brown being confined to the spots above callosities over eyes. Anterior oblique vitta indicated at lateral margin by a usually well developed white spot with a tendency to run forward along margin, and which, in the type and in some other specimens before me, but not in all, rises with indefinite forward bounds toward anterior lower corner of mid-dorsal translucent spot but does not reach it. This vitta is bordered posteriorly by a narrow black line which curves up and forward to lower anterior corner of mid-dorsal white spot, and then rises abruptly along the anterior edge of the latter to summit; a branch also sometimes runs forward from lower anterior corner of mid-dorsal white spot to anterior white spot, and then bordering the latter posteriorly rises to summit. Keel on rising from metopidium blackish, immediately succeeded by a large white spot, thence rich dark red to apex, interrupted by squarish (sometimes elongate) prominent mid-dorsal translucent spot and by anteapical vitta. The latter white, broad, extremely so on carina, narrowing as it approaches lateral margin, its posterior border



sloping strongly cephalad from summit to margin. Dark red surface of apical process somewhat besprinkled with small testaceous spots.

Body beneath dingy testaceous.

Fore wings clear hyaline, veins flavous, tips from below apical process of pronotum broadly very dark fuscous, anterior border of fuscous cloud squared, covering terminal areole.

Legs dingy testaceous, femora above on all legs shining jet black.

Length 5 mm.

MALE: Like the female, but decidedly smaller, arching evenly and much lower, markings usually the same, and differing only as follows:

Face washed with red, sutures between clypeus and loræ black. In some specimens face is dirty testaceous, black centrally above and adjacent to eyes.

Pronotum rather low, sinuations much less marked, apical process hardly attaining basal angle of terminal areole of fore wings. Base of metopidium and humeri washed with pink in allotype and some specimens, in others dingy testaceous. Sometimes the whole of metopidium is thus washed, and the brown mottling seen in the female lacking. The dark red of the pronotum in that sex varies in the male from black to pale red. The oblique anterior vitta here shows a tendency, more rarely seen in the female, to form a connection with anterior white spot on carina.

Body beneath and abdominal segments black; genital segments and organs clear testaceous, hooks of styles and caudal half of keel of sternal plate black.

Fore wings often very slightly suffused with flavous, fuscous at tip, in most specimens at hand the clouding not reaching apex of pronotal process, but covering terminal areole as in female.

Legs dull testaceous, femora above black.

Length 4.5 mm.

Holotype ♀. Lakehurst, N. J. VII/2/'22. Taken on *Quercus prinoides*.

Allotype ♂. Lakehurst, N. J. VI/16/'17. "Beating Oak," Both in my collection.

Paratypes: Three males and twenty-six females, Lakehurst, N. J. In my collection. Also one male and one female, same locality, in collection of W. T. Davis.

This little species is not likely to be confused with any other than *puritanus* herein described, from which it may be distinguished by its slightly greater size, its coarser, rougher punctuation, wholly lacking any lustre, notably over the shoulders; by the swelling of pronotal crest between anterior and mid-dorsal spots, that part being included in the dorsal compression of *puritanus*;

by the greater extension of pronotal apical process in the female; by the brown mottling of metopidium and over humeri, particularly in the female; by the conspicuous white anterior spot, the somewhat narrower mid-dorsal translucent spot, and in the female the dark red apical process besprinkled with white; by the black superior surface of the femora of all the legs in the female, and the much darker and more extended apical cloud of the fore wings.

It has been found by me almost without exception on *Quercus prinoides*, and I have no doubt that that is its preferred if not exclusive host plant.

Of this species I have seen none but Lakehurst examples except from localities on the south shore of Long Island, N. Y., the fauna and flora of which is in many respects notably like that of the "pine barrens" of southern New Jersey, and a series of one male and five females taken on "scrub oak" at Karner, N. Y., a locality where both *Quercus ilicifolia* and *Q. prinoides* abound.

*Cyrtolobus puritanus* new species.

The following new species is the smallest of the genus known to me, as well as one of the liveliest in both sexes. My captures have been but a fraction of those shaken into my umbrella. It is especially neat in appearance, and in form, color and pattern roughly suggests a miniature *van*. From other small species it is most conspicuously differentiated by the disproportionately large mid-dorsal translucent spot, and the marked compression of the pronotum in that region. Figures of specimens of both sexes are herewith presented, and their description follows:

*Cyrtolobus puritanus*, new species. (Plate V, Figs. 33, 34.)

FEMALE: Moderately elevated, but notably small; punctures rather distant, shallow and small over humeri; somewhat shining; dark reddish brown with the usual white markings slightly dingy; the mid-dorsal translucent spot conspicuously broad.

Face between eyes broader than long, hairy, testaceous, sparsely covered with small pink punctures, darker bordering eyes and on frons. Clypeal sutures indistinct, those bordering loræ indicated by red lines in holotype, by brown in other specimens, the loræ produced below genæ; clypeus broad, incurved.

Pronotum strongly compressed at the middle for at least half its height, the keel consequently sharp and narrow, including in considerable degree

that part of the crest anterior to mid-dorsal translucent spot. It arches from base of metopidium to highest point above post-humeral sinus and a little before mid-dorsal spot, further rearward than in *parvulus* Woodr. (ante), and thence slopes to apex with posterior sinus slight but evident. Anterior sinus absent, but indicated by a very small white spot placed far forward at summit of metopidium. Posterior process attains apex of terminal areole of fore wings. Metopidium hairy, testaceous at basal middle, narrowly over humeri, and at margins of post-humeral sinuses. Carina of metopidium black, interrupted by four successive white spots. Two reddish brown bands arise at callosities over eyes, expand above, becoming a brighter red over humeri, and extend broadly beneath mid-dorsal translucent spot to anterior margin of white oblique vittæ. The latter arise at mid-lateral margin, are sharply defined, gradually narrowing and running into mid-dorsal spot at about the middle of its lower edge and not extending beyond it. Mid-dorsal translucent spot conspicuously large—broad, deep, squarish—extending below base of deep compression, but broader than deep. Surface anterior to it dark red with black punctures, and posterior to it wholly dark red. Anteapical vitta rather broad, widening broadly on carina, bordered anteriorly with black punctures. Apical process beyond this vitta long, about one-quarter the length of pronotum along lateral margin, testaceous, sparsely punctured with black.

Body beneath testaceous, ovipositor dark basally.

Fore wings dingy hyaline, veins flavous, apex very slightly infuscated.

Legs pale testaceous, fore femora slightly infuscated above.

Length 4.40 mm.

MALE: Like the female, slightly lower and smaller; color darker and richer, with the white markings a clearer white, and differing only as follows:

Face more or less washed with red, in some specimens with brown, and with many black punctures, including clypeal sutures.

Pronotal callosities over eyes black, punctures rather fine, distant and black; apical process more or less blunt, dark red with black punctures, attaining only to basal angle of terminal areole of fore wings.

Body beneath and abdominal segments black, genital segment pale, styles and lateral valves black.

Fore wings clear hyaline, a broad fuscous cloud along apical margin broadly invading terminal areole, veins blackish.

Legs pale, all the femora above black.

Length 4.10 mm.

Holotype ♀. Litchfield, Conn. VII/8/'21. Taken on *Quercus coccinea*.

Allotype ♂. Same locality and host plant. VI/15/'22. Both in my collection.

Paratypes: Three males and four females, Litchfield, Conn., in my collection; one male and one female each, as follows: White Lake, Can.,

Funkhouser collection; Lake Toxaway, N. C., Slosson collection; Roselle Park, N. J., coll. Am. Mus. Nat. Hist., N. Y.; Auburndale, Mass., coll. C. W. Johnson; Jamesburg and Cranford, N. J. respectively, Davis collection; and females as follows: St. Anthony Park, Minn., coll. Univ. Minn.; Atherton, Mo., coll. Univ. Kansas; Pleasant Valley, Conn., coll. Brooklyn Museum.

A very considerable series of this species is before me, including material from Toronto, Can., New York, Long Island, N. Y., Pennsylvania, and Georgia, in addition to the states above cited. It is a very distinct little species, particularly notable for its small size and proportionately large, square, strongly compressed mid-dorsal translucent spot, and its clear unmottled coloring. It has been found confused in several collections with the species last above described (*C. parvulus* Woodr.), both masquerading under the label *vau*. Its distinction from *parvulus* has been fully pointed out in the discussion of that species. From the records at hand it is evidently widely distributed throughout the north and east, extending south in the higher altitudes.

*Cyrtolobus acutus* Van Duzee.

The remarkably narrow and produced clypeus serves as an excellent specific character by which to recognize this very slender small species, marked with the usual vittæ and pellucid spot so prevalent in the genus. Its habitat seems to be in the mountainous parts of our central-western and southwestern states.

*Cyrtolobus maculifrontis* Emmons.

I am somewhat at a loss to account for the close association to "*vau*", taking that reference to mean the species here designated as pale *fuliginosus*, accorded this species by Van Duzee in his "Studies", as well as for the extreme length with which he there credits it. His characterization of the species in other respects certainly accords with the extensive material which I have accumulated; but that material is of one of the decidedly smaller species, the females measuring from an extreme length of 5.5 mm. down to 4.5 mm., and the males averaging less, as usual; and their appearance is very distinctive, much more nearly approaching *intermedius* than *vau* or *fuliginosus*. It may be that a pale speci-

men of the former, heretofore commonly associated with *van*, was in mind. In this connection I might advert to the possibility of the confusion of two species here. It may be observed that Mr. Van Duzee based his remarks on *maculifrontis* primarily upon a series taken by him in Georgia. The males of my Alabama material, and a series of males before me from Clayton, Ga. (W. T. Davis) and Southern Pines, N. C., average considerably larger than northern males, and are wholly pale beneath instead of black. Nevertheless, their general habitus is that of this species, and I do not feel warranted in separating them. Mr. Van Duzee's question of the accuracy of Emmons's figure must have been due to paucity of examples, for the anterior oblique vitta frequently is apparently transverse, arising vertically from the lateral margin and joining the mid-dorsal translucent spot, its forward extension obscured. Between this combination transverse band and the anteapical vitta the pronotum is usually contrastingly darker than the surface anterior to it. This is true in both sexes; but it should be borne in mind that the markings in this species tend to obsolescence. The anteapical vitta is wide and crosses the posterior process unusually near its apex. This feature, and the dark surface before it, the somewhat hairy character and coarse punctuation of the pronotum, and in the male its abbreviation, the lateral margin curving upward to apex so as to expose an unusual proportion of the flavous hyaline fore wings without apical cloud, serve to aid in the identification of those frequent specimens in which the black blotches on the metopidium are lacking. The figure of a male is herewith appended on Plate V, Fig. 42, in which the yellow pigment of pronotum is replaced by a rich brown, the frontal pronotal blotches and other markings sub-obsolete, but the posterior darker saddle nevertheless evident. This color form is common. The specimen figured was taken at Litchfield, Conn., VI/29/'20 on *Quercus alba*, and measures 4.45 mm. in length.

*Cyrtolobus intermedius* Emmons.

*Cyrtolobus intermedius* Emmons is a species which, as I understand its status, is subject to wide range in color and definition of pattern, in some respects wider than in *rufulus* herein described. The species was founded by Emmons on what was probably a female specimen, of a wholly dark mahogany red without

evident vittæ or other markings, and well figured on Plate XIII, Fig. 16, of Vol. 5, Agri. Nat. Hist. of New York (1854). Examples of such females are by no means rare; but those with the presence, indicated in varying degree, of vittæ and the mid-dorsal translucent spot on the dark red surface are more frequently met with, and this surface color itself, if I apprehend the species aright, tends to range through lighter and lighter shades till the extreme of pale creamy color, with markings again obliterated, is reached. The more common forms are predominantly pale with the usual *Cyrtolobus* pattern, and of these I have examples which I have taken *in copula* with males absolutely indistinguishable from males thus taken with females of the dark red mahogany form. Furthermore, no structural feature to differentiate the pale and dark forms can be discerned by me, while some marked characters are shared by both. Though invariably separated in the collections examined, the pale ones variously assigned, usually either to *van Say*, *fenestratus* Fitch, or *discoidalis* Emmons, the conclusion seems irresistible to me that they are the same. The figure of a very pale reddish yellow female with markings obscurely indicated is here shown on Plate III, Fig. 22. It was taken at Litchfield, Conn., VI/23/'22, in copulation with the male shown in the accompanying Fig. 21, and as that color phase differs widely from the type form and has not yet been described, its description is herewith presented in detail.

#### *Cyrtolobus intermedius* Emmons.

FEMALE: A pale yellowish, low arched species, almost testaceous, with the usual vittæ and pellucid dorsal spot present, but tending to obsolescence. Punctuation rather fine, granulate.

Face between eyes but little wider than long; clypeus broad, somewhat produced, but only slightly below line of genæ, sutures distinct. Color yellowish testaceous, sparsely covered with slightly reddish, or more frequently black, punctures.

Pronotum low, rounding over humeri, arching very little, highest back of post-humeral sinus, strongly compressed at mid-dorsal translucent spot as though with blunt-pointed forceps, producing a seemingly foveate compression beneath that spot; a little swollen in outline and laterally between mid-dorsal spot and anteapical vitta; posterior process hardly differentiated, not decurved, reaching middle of terminal areole of fore wings. Color pale yellowish on metopidium, with two narrow light red bands rising from callosities over eyes toward but not reaching its summit over humeri. A

more or less indistinct dingy white anterior oblique vitta arising from middle of lateral margin, curving forward well below small mid-dorsal translucent spot, and reaching carina of crest above post-humeral sinus, back of which the pronotal surface is dull light reddish, more or less mixed with yellowish. Anteapical vitta vertical, correspondingly obscure. In some specimens the anterior and posterior parts of the pronotum are more contrastingly yellowish and reddish respectively; and in many the surface is generally suffused with dark reddish, suggesting the type form; but even in these the short shoulder stripes are discernible, and the weak vittæ and mid-dorsal translucent spot are more evident in contrast.

Body beneath flavous.

Fore wings hyaline, rather dark reddish over corium, veins and terminal border distinctly flavous. No terminal cloud.

Legs pale testaceous.

Length 5.60 mm.

The male of this species, not heretofore described, is characterized below, its description being drawn from a specimen taken by me in copulation with a dark red female closely corresponding to Emmons's figure, but with the mid-dorsal translucent spot present. It is practically indistinguishable from the male shown in Fig. 21.

MALE: Smaller and even lower than female.

Face testaceous, unevenly marked with black punctures. Clypeus but little produced.

Pronotum with characteristic fovea below mid-dorsal translucent spot; apical process not reaching to basal angle of terminal areole of fore wings. Metopidium testaceous centrally to its summit, dingy white laterally above eyes, over humeri and along post-humeral sinus and lateral margin to a conjunction with anterior oblique vitta at its marginal origin. This vitta in the specimen in hand is much interrupted by the black of pronotal surface. Bands from callosities over eyes black, in some specimens dark reddish brown, expanding on summit of metopidium and continued back so as to fill the space between the dingy white of the oblique vitta and lateral margin. The remainder of the pronotal surface in this and most specimens is black, the white mid-dorsal translucent spot and anteapical vitta in sharp contrast against it. In many examples however the black of the pronotum is replaced by brown or by a dark red.

Body beneath black, lateral valves of genital segments and sternal plate dark red.

Fore wings hyaline, with dark red corium, and dark fuscous cloud almost covering terminal areole and apical portion of cell above it.

Legs testaceous, femora above black.

Length 5.50 mm.

Allotype ♂. Litchfield, Conn. VI/30/'23. In my collection. Taken with female in copulation, on *Quercus coccinea*.

This species, in size decidedly smaller than *vau* Say, with which it is often confused, is, as stated above, generally pale in the female, with the male very similar to the male of that species. In the latter sex the conspicuous extension of the pale color of the anterior oblique vitta from its lateral origin forward along margin of pronotum and over post-humeral sinus to base of metopidium will serve to distinguish it from *vau*, while both sexes are characterized by the strong foveate impression at the base of the mid-dorsal sub-pellucid spot, and by the base of the fore wings being dark reddish, the apices of those of the female without fuscous cloud.

It may be worth while to call attention to the humeral bands in this species for the purpose of emphasizing that their presence is not to be taken as the exclusive hallmark of *discoidalis* Emmons. Several other species possess them as well. Its distribution is general throughout our northeastern territory; and in New York, including Long Island, and Connecticut, the state in which most of my collecting has been done, it is abundant, and is found on almost any species of large oak.

*Cyrtolobus gratiosus* new species.

The following new form, apparently represented in my collection by both sexes, and from their general habitus seemingly entitled to specific recognition, is nevertheless accorded it here with some diffidence. The difficulty lies in delimiting it, owing to the very scanty material thus far observed which I have felt warranted in segregating as components of this species. The several specimens which have been associated in my box with those hereinafter designated as the types have been so allocated tentatively; yet no other assignment of them seems to me plausible; nor do the types seem very closely related to any known form, pale specimens of *intermedius* Emms. perhaps presenting the nearest approach to them. It is earnestly hoped that further material will be acquired which will tend to furnish a clearer apprehension of this species, particularly a copulating pair, as the holotype and allotype herein described are associated together as one species only by reason of similar facies and a common locality of capture. It is below medium size, very little elevated on pronotal carina,



its most distinctive superficial character being the olivaceous yellow of the fore part of the pronotum.

**Cyrtolobus gratosus**, new species. (Plate III, Figs. 23, 24.)

FEMALE: Face between eyes a quarter wider than long. Yellowish testaceous, coarsely punctured. Clypeus moderately incurved, its sutures at loræ outlined with black punctures, such punctures condensed at inner margins of eyes and on frons. Eyes dark.

Pronotum anterior to the oblique vitta olivaceous yellow, marked with two narrow reddish bands arising at inner edge of callosities above eyes but hardly extending above humeri. Anterior and posterior carinal sinuses evident but not deep, pronotum arching very slightly and almost evenly to apex, which is produced only as far caudad as the basal angle of terminal areole of fore wings. Anterior oblique white vitta is somewhat obscured above by the olivaceous coloring that borders it anteriorly, meets the lateral margin behind the middle and broadens somewhat as it approaches it. Mid-dorsal translucent spot conspicuous, rectangular, wider than deep, not extending below compression. Anteapical white vitta broad, distinct, vertical. Pronotal surface otherwise blackish brown, darkest bordering the vittæ, along carina and at apex.

Body beneath testaceous.

Fore wings clear hyaline, veins contrastingly dark, the terminal areole large, its sides diverging at more than a right angle. Apex very slightly clouded, the terminal areole scarcely invaded.

Legs testaceous.

Length 5.60 mm.

MALE: Like the female, a little smaller and even less elevated. Colors deeper.

Pronotum with the anterior oblique vitta quite obliterated superiorly by the invading olivaceous brown. In some specimens this olivaceous tint becomes lost, the forward pronotal surface being grayish brown, in certain examples which I have tentatively associated with the allotype here are correctly so associated.

Body beneath black, the genital segments flavous, tips of the organs black.

Fore wings as in the female, their tips slightly more infuscated.

Legs testaceous, fore femora above black.

Length 5.5 mm.

Holotype ♀. Litchfield, Conn. VII/1/'20. Taken on *Quercus rubra*.

Allotype ♂. Litchfield, Conn. VI/22/'20. Taken on *Quercus coccinea*.

Both in my collection.

It has been suggested above that this prettily marked species is perhaps most nearly like *C. intermedius* Emmons. It is however distinguished from the paler forms of the female of that

species as here understood by being much more contrastingly patterned between the fore and hind parts of pronotum, less elevated, fore wings clearer hyaline, and lacking the deep foveate character of the dorsal compression which marks that species whatever its color variation. The males are more difficult to differentiate satisfactorily, though here again the foveate impression below the mid-dorsal compression is not so deep, and the broad dark humeral bands are lacking. Figures of both holotype and allotype are herewith presented.

*Cyrtolobus griseus* Van Duzee.

This species was described from three females taken at Effingham, Kansas, and is rather widely distributed in the middle west. The length of a female of average size from Illinois, which Mr. Van Duzee has kindly compared for me with the type, and which he pronounces the counterpart of a paratype taken with the type, is 6.25 mm., thus materially exceeding the average length, 5.60 mm., of the female of *C. cinereus* Emmons, or as determined in this paper *C. pallidifrontis* Emmons, with which it was compared in the original description; but while it doubtless averages larger than that species, some specimens at hand are of substantially the same size. All seen by me, however, have their legs wholly pale, and the arch of the pronotum, while low, decidedly greater and higher anteriorly than in that species. Examples occur in which the gray of the pronotum back of the anterior vitta is somewhat reddish, sometimes decidedly so. Such specimens approach in general appearance many northern examples of a species which I am not able to distinguish satisfactorily from one taken in the south, hereinafter described under the name *C. rufulus*, typically smaller and from typical *griseus* evidently distinct. It may be that these seeming intermediates are themselves entitled to specific rank, but I do not feel justified in so recognizing them at present.

Regarded as a member of the group which includes the three following species as well, *griseus* may be distinguished from the others as decidedly the greatest in size; and from the species most nearly approaching it in that particular, *pallidifrontis* Emmons, it differs in having all the femora wholly pale, and the fore wings immaculate except for a slight apical cloud.

*Cyrtolobus pallidifrontis* Emmons and *cinereus* Emmons.

*C. pallidifrontis* Emmons was figured without description, but with what appears to be an excellent representation of the female, in the Natural History of New York, Part V. Agriculture, Plate XIII, Fig. 7. Its recognition, however, has usually proven to be a stumbling block. The suggestion is here made that this species is that which stands in most collections under the name *cinereus* Emmons. Students of the group have generally recognized as that species a form widely distributed in the north and east with unusually low pronotum and fore wings maculate at their middle, and so assigned by Van Duzee in his "Studies"; but there is no doubt in my mind that the species so recognized is *pallidifrontis* Emmons, and in all probability not *cinereus* Emmons. For several years I have had a series of specimens which, following\* the customary recognition of *cinereus*, have stood in my box under that specific name, with the special label *pallidifrontis* placed at their side, so closely did they conform in shape, coloring and pattern with the figure of the latter cited above; and recently I discovered a grayish specimen among the material acquired by the United States National Museum from the Fitch collection with a narrow green label bearing the name *pallidifrontis* in handwriting. Emmons states (p. 153, Footnote) that his account of the Membracidae is based upon Fitch specimens. This specimen, upon direct comparison, agrees almost exactly with Emmons's figure in form, shading and markings, including the unusually broad anteapical vitta, slightly exaggerated in the figure. It also agrees substantially with the above mentioned specimens in my box. Notwithstanding that it is a little less gray, it accords so closely with the figure that it may be the actual specimen from which it was drawn! I believe the probabilities are in favor of that presumption. In that case this specimen, bearing also a label with the number 11,763, has a plausible claim to be regarded as the type of *pallidifrontis* Emmons, and can at least be chosen as its lectotype, as is here done. It follows that what we are calling *cinereus* should be known as *pallidifrontis*. Under the name *cinereus* Emmons this species has been described by Van Duzee on page 91 of his "Studies" (ante), and in greater detail by Funkhouser on page 276 of his "Biology of the Membracidae

of the Cayuga Lake Basin",<sup>1</sup> so a further description is not presented here, other than to point out that the above mentioned National Museum specimen has a pale pinkish wash on face and metopidium, and a reddish tint on pronotum between the posterior black border of oblique vitta and anterior black border of antepical vitta, these tints not shown in the figure. The specimen also has reddish spots above the metopidian frontal callosities, indicating the beginning of obsolete supra-humeral bands, a broadening downward of the pale anterior vitta to the lateral margin, and a broad but very shallow mid-dorsal translucent spot. The fore wings are clouded at base, middle, and very broadly at apex, entirely infuscating the terminal areole and encroaching on its neighbors. The black of the femora above, characteristic of this species, is shown in the figure.

Now as to whether the two names are of one species. A comparison of the two figures in question, both given on Plate 13, assuming them to represent the same sex, as well as the inapplicability of the description of *cinereus* to the figure of *pallidifrontis*, render that hypothesis untenable. Nor is it supported on the assumption that the figure and description of the former were drawn from a male specimen. I have never thought that Emmons's figure of *cinereus*, or his brief description itself, accorded at all well with either sex of the species generally assigned to it. He describes particularly (p. 156), and figures graphically (Fig. 3), a brown insect with a broad lighter brown sagittate mark on the anterior dorsal surface of the pronotum. What we know as *cinereus* would, in the female at least, hardly be called brown, nor does it accord in color with his figure. Since the males are frequently brownish, and often have the mid-wing maculation obsolescent, I have given special consideration to the possibility that Emmons had a male specimen of this (or some other) species before him in describing and figuring *cinereus*, but no specimen has been found by me to accord with either description or figure. As to the arrowhead mark, in the very large aggregate of specimens of both sexes which I have examined, literally hundreds, I have never seen this matched, hardly approached. The conspicuous maculation of the fore wings of the female of

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<sup>1</sup> Cornell Univ. Agri. Exp. Station. Mem. II. 1917.

this species (*pallidifrontis*) is not referred to in the brief description of *cinereus*. My conclusion is, *pallidifrontis* Emmons is a good species, identifiable, not synonymous with *cinereus* Emmons, and that we do not know *cinereus*.

It should be noted that in eastern New York and New England *pallidifrontis* is usually more grayish than red, but that with the grayish form reddish specimens also are found, the reddish ones, however, predominating in western New York, Pennsylvania, and Illinois. But these are clearly all one species. For convenience of reference figures of both sexes of this very low and elongate species are hereto appended (Plate IV, Figs. 25, 26), the specimens having been taken at Litchfield, Conn.

*Cyrtolobus gramatanus* new species.

The following new species belongs to the group having fore wings maculate at the middle. From *pallidifrontis* Emmons, as I recognize that species (above), it differs in the female by being smaller, and arching proportionately and actually higher anteriorly, the crest from frontal view higher above humeral plane, and the depth of the mid-dorsal translucent spot therefore greater; in having the pronotum back of the anterior oblique vitta usually bright red; in the total absence of black from the femora of both sexes; and in the less squared terminal cloud of fore wings. Its type of ornamentation is that of *pallidifrontis* as figured by Emmons, but contrary to the character of pigmentation disclosed by a large series of that species, the colors are much clearer and more sharply defined—not at all confluent as they frequently are in *pallidifrontis*. It is further distinguished from that species by its coarser punctuation, its surface therefore rougher than in *pallidifrontis*, which has a rather silvery sheen. In the male it differs particularly in being proportionately higher arched, and its coloring and pattern are more usually very much as in the female, instead of commonly black or brown as in that species. In fact, it is not very closely related to it, being here compared with and differentiated from it because both have the fore wings maculate at middle. Figures of a male and female of this new species, taken *in copula*, are herewith presented, and their description follows. The name selected was that of the Chief of the Indian tribe which originally had as its home and hunting grounds

that part of the country where I have found this species most abundantly, to-wit, the type locality.

*Cyrtolobus gramatanus*, new species. (Plate IV, Figs. 27, 28.)

FEMALE: Rather small, moderately arched, its coloring more or less sharply contrasted by delimiting black lines; its fore wings strongly maculate at base, middle and apex with brown.

Face testaceous, usually immaculate and washed with rose, sutures distinct, clypeus very little produced.

Pronotum arching moderately, commencing its even curve well forward immediately above humeri, the middle of dark space between incidence of anterior vitta on carina and mid-dorsal spot also well forward, intersected by an imaginary vertical line arising from posterior point of post-humeral sinus, the summit of the crest attained at the anterior angle of the mid-dorsal translucent spot. Metopidium yellowish testaceous over humeri, more grayish centrally, with black carina. From callosities over eyes arise two broad brick-red bands curving over humeri to rear of post-humeral sinuses. Humeri themselves are very often brick-red. Anterior white spot on carina above post-humeral sinus small, but usually present. Anterior oblique vitta arising from lateral margin forward of middle, directed toward dark space posterior to anterior white spot on carina, and rarely connected with the latter by irregular white maculations, usually abruptly terminating about half way to summit, though occasionally showing at this point an indistinct horizontal forward extension which rises again to anterior white spot; this vitta bordered behind and interruptedly before by broad black lines. Anterior to this vitta the pronotum is more or less maculate with white. Mid-dorsal translucent spot conspicuous, broad and rather shallow. Anteapical white vitta erect, exceptionally broad, especially on carina, bounded before by a broad black line; the space between these vittæ bright red. Apical pronotal process beyond the vitta usually rather short, blunt, and testaceous with brown punctures, attaining middle and at times apex of terminal areole of fore wings.

Body beneath pale yellowish testaceous.

Fore wings hyaline, clouded at base, middle and apex with brown, the cloud broad and distinct at middle, rounded at apex, covering terminal areole.

Legs, including femora, pale yellowish testaceous.

Length 5.20 mm.

MALE: Like the female, but lower.

Face wholly testaceous; the reds of crest becoming dark brown or black on metopidium, on central pronotum very dark red; the vittæ lack the delimiting black lines, and so are less sharply contrasted, but the anteapical vitta is usually broad, as in the female.

Body beneath and abdominal segments laterally black, ventrally pale testaceous.

Fore wings hyaline, apical cloud rounded, cloud at middle sub-obsolete.

Legs, including femora, pale testaceous.

Length 5. mm.

Holotype ♀. Bronxville, N. Y. VI/14/'14. Taken on *Quercus platanoides*.

Allotype ♂. Same locality, date and host plant. Holotype and allotype taken in copulation. Both in my collection.

Paratypes: A large series of both sexes from the type locality are before me, which may be regarded as paratypes.

Besides those taken by me for several years past at Bronxville, Westchester County, N. Y., mostly on *Quercus platanoides*, including several copulating pairs, I have seen many specimens from Long Island, N. Y., and the lower Hudson River region and from New Jersey, as well as one female in Mr. Olsen's collection from Rutland, Vermont.

The possibility has been considered and rejected that this species might be that figured and described as *cinereus* by Emmons, not yet recognized by me. While it is common in at least parts of New York, from which State most of Fitch's and Emmons's material probably came, it does not correspond with either the description or the figure of that species. For instance, it lacks the dorsal sagittate mark which is both described and represented in the figure of *cinereus* (Nat. Hist., N. Y., Agri. V, Plate XIII, Fig. 7), and in comparison with the outline there given has a much greater pronotal arcuation. There seems to be no other described species to which it may be referred, and it is therefore presented as new.

### *Cyrtolobus rufulus* new species.

The following new species, as its name implies, is a reddish one, founded on a few female examples taken in Alabama, of less than medium size with rather low pronotum, notable in having its anterior half a lighter shade of red than the posterior half, the division along the line of an oblique vitta which is absent, as are all other markings. However in the specimen chosen as holotype and figured herewith the oblique vitta is indicated not only by

the abrupt transition from one shade of red to the other, but by a distinct thinning of the red wash on the yellowish ground color of that region, particularly on its lower half. Another outstanding character of these specimens is the strong triangular maculation of the middle of the fore wings, preceded by a pinkish wash, in this respect recalling *pallidifrontis* Emmons as here recognized. But the legs are always wholly pale, lacking the shining black of the femora above, so characteristic of that species in both sexes. At the same locality numerous pinkish specimens were taken of similar form, though seeming to average a little smaller, with both anterior oblique and anteapical vittæ present, frequently outlined with black, as well as with a distinct mid-dorsal pellucid spot, and with fore wings quite devoid of maculation at their middle. At first I regarded these as distinct from the above; but a considerable series seems to show every gradation between the two forms, including vittate specimens with maculate fore wings, and those with the vittæ obsolete and the fore wings clear at their middle. No structural character has been discovered by me by which they may be specifically separated, and I am constrained to regard them as one. The description of the selected types of both sexes follows, their figures being appended hereto.

**Cyrtolobus rufulus**, new species. (Plate III, Figs. 19, 20.)

FEMALE: Under medium in size, arch low, surface with a smooth appearance due to its unusually small even punctures; reddish, darker on posterior half; in holotype without vittæ or mid-dorsal translucent spot, and with fore wings triangularly maculate at middle.

Face yellowish, strongly suffused with red; clypeus little produced, rather broad and moderately incurved, its yellowish ground color also washed with red, but less strongly.

Metopidium hardly receding from plane of face till level with top of humeri; thence pronotum retreats almost horizontally to above post-humeral sinus in holotype, and then rises again, the rise being more gradual in most specimens from top of metopidium to low summit back of post-humeral sinus, thence unevenly sloping downward, with sinuations at positions of mid-dorsal translucent spot and anteapical vitta, both lacking, to tip, which attains middle of terminal areole of fore wings. Anterior half of pronotum overspread with dull red back to position of an oblique vitta, in the holotype that vitta indicated by a broad triangular yellowish spot at lateral margin, and supra-humeral bands by obscure subtending pale lines; the whole posterior half rich mahogany red without pattern, but with a moderate mid-dorsal compression.



Body beneath yellowish testaceous, sides of abdomen encarnadined.

Fore wings marked with blackish brown clouds at base, middle and tip, that at middle broadly triangular preceded by a pinkish area, that at tip rather round, covering terminal areole and apical third of cell above it.

Legs wholly yellowish testaceous.

Length 5.60 mm.

MALE: Smaller and much lower than the female, though still distinctly arched; vittæ present.

Face and anterior half of pronotum suffused with red as in the female.

Metopidium with supra-humeral bands more evident, but obscure, the surface above and sides of pronotum anterior to oblique vitta more or less mottled with numerous small black areas, the triangular pale area at lateral margin evidencing the oblique vitta whitish instead of yellowish, its summit indicated by a pale spot on carina. Mid-dorsal pellucid spot obscure except on carina, the compression moderately deep, and the antecapical vitta white, vertical, broad; very narrowly bordered anteriorly with black, before which the pronotum is bright red. Tip brownish red, a little exceeding the angular base of terminal areole of fore wings.

Body beneath testaceous with more or less black anteriorly and on sutures, abdominal segments on sides black bordered with red, genital plate with tip and styles black.

Fore wings maculate as in female, but much less heavily at middle.

Legs wholly pale.

Length 5 mm.

Holotype ♀. Hazen, Ala. IV/2/'21. Taken on *Quercus alba*.

Allotype ♂. Same locality. V/2/'23. Taken on *Quercus minor*. Both in my collection.

Paratypes: Same locality. Several males and females, in all about fifty, a great majority of which are those with vittæ prominently present, are before me; and if, as I believe, they are all of the same species, they may be regarded as paratypes.

Were I challenged with respect to assigning the above male to the holotype as of the same species, my excuse would be the lame one that similar males were taken commonly with the corresponding vittate females at the same place, though not noted in copulation, and that it looks as though it belonged with it. In the absence of proof to the contrary, I regard the presumption sufficiently great to warrant my so assigning it. But the real difficulty is presented by those females that have the vittæ and mid-dorsal pellucid spot fully developed. Where the vittæ are outlined with black, as often occurs, I find considerable trouble

in pointing out characters to distinguish them from certain females of *gramatanus* Woodruff (ante), the seemingly constant presence of the middle cloud in the fore wings of the latter not being sufficiently diagnostic, as such a cloud is often present or indicated here. It is true that this southern species is a pinkish red insect even when patterned like the northern more grayish *gramatanus*, and compared with specimens of the latter from its type locality seems to average lower, longer with less contrast between color of pronotum before and behind middle, the anterior oblique vitta usually sharply angulated at its middle when considered from its front margin instead of actually interrupted there as in *gramatanus*, which latter seems to present a larger and more conspicuous mid-dorsal translucent spot. Yet specimens are found in which these slight differences tend to disappear; and were it not that the non-vittate forms, with which these seem to merge, are so thoroughly unlike *gramatanus*, I would hesitate to separate them from that species. In order to exemplify what seems to be the range of variation in the species at its type locality I append figures of another specimen of each sex (Figs. 17, 18) which will show the approach toward *gramatanus* above noted. Descriptions of these follow:

FEMALE: Face reddish yellow, punctures of frons black.

Metopidium at base and on central third to summit testaceous yellow, centrally with black punctures. Sides of metopidium reddish yellow, with broad deeper red bands from callosities above eyes running up over humeri. Between humeri and anterior oblique vitta testaceous heavily mottled with black, that vitta testaceous white, arising from before middle of lateral margin, broad at origin, vertical to a point close to anterior lower angle of broad squarish mid-dorsal translucent spot, thence narrowly and irregularly forward, and again rising and expanding on summit of crest over post-humeral sinus. This vitta is bordered posteriorly with black, back of which the pronotum is an even rich dark red interrupted by the vertical white antepical vitta, which expands forward on crest and is bordered before and broadly behind with black. Tip testaceous.

Body beneath black anterior to abdomen, otherwise reddish testaceous.

Fore wings slightly enfumed, fuscous at base, on veins at middle, with rounded terminal cloud covering the terminal areole and apex of cell above it, but not extending up along margin.

Legs pale.

Length 5.5 mm.

MALE: Like the female above described, but smaller.

Pronotum with anterior oblique vitta at summit of crest, and mid-dorsal translucent spot, much reduced; black borders of anteapical vitta obsolete, tip wholly red.

Fore wings with pronounced triangular cloud at middle; often almost or quite devoid of it. Terminal cloud as in the female but darker, in a series very variable in extent and definition.

Legs pale; basal portion of femora in front (not above) with a more or less continuous and broad brownish stripe, often lacking.

Length 4.80 mm.

These were taken at the type locality IV/9/'21 and V/5/'23 respectively, and are in my collection, there distinguished as "*form ornatulus*" from the typical non-vittate form. The pronotal sinuation of both figures of the female presented is individual, though the species has a tendency toward it at those parts of the carina usually marked with pale; most specimens showing an even arc to tip.

In addition to the material from the type locality I have examined several specimens from New Jersey, Staten Island and Long Island, N. Y., one female from Ocean Sp., Miss. (Funkhouser Coll.), and one bearing label "Topeka Ks. Popinoe", one from Louisiana and a pair from Texas in the United States National Museum. Extensive material from Illinois, Wisconsin, Minnesota and S. Dakota has also been seen, which I range with this species, though with some hesitation. If correctly placed, it would appear that northern specimens average somewhat larger and less pinkish than those from the south.

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This group, consisting of *griseus* Van D., *pallidifrontis* Emm., *gramatanus* Woodr., and *rufulus* Woodr., presents more difficulties than any other in the genus. Typically the species are severally abundantly distinct; but specimens are continually coming to hand which combine in bewildering fashion the characteristics in pattern, size, color, etc., of two or more of them, so that their recognition is problematic. In all the structure of clypeus and pronotum, as well as the pattern, is very similar, and the fine punctures of their surfaces give the effect of a sheen which is distinctive, not of one species, but of the group. In fact we have here a marked instance of the condition of the family as a whole,

the several genera made up of numerous forms whose characters seem to be somewhat in a state of flux. As classification has as its purpose not only the expression of such relationships as we find in nature, but also a terminology which we may conveniently use in the study of these several forms, the best we can do here is to recognize as so-called species those which exhibit outstanding differences, and grade those with them which seem to approach them most closely, bearing in mind as checks both locality of capture and host plant.

*Cyrtolobus fuscipennis* Van Duzee.

In *Cyrtolobus fuscipennis* Van Duzee we find an extraordinary range of color, particularly in the female, where the gamut runs from very dark red thickly overlaid with black, but not obscuring the vittæ, to pale whitish and creamy examples with the markings obsolete. In all phases of both sexes, however, in addition to the smoky wings, a somewhat variable though distinctive character, the tip of the pronotum behind the anteapical vitta seems to be almost always red in some degree, furnishing a fairly good specific mark in this otherwise well characterized species. The male has not heretofore been described. A figure of a specimen of that sex is hereto appended, and its description follows:

*Cyrtolobus fuscipennis* Van Duzee. (Plate VI, Fig. 49.)

MALE: Face crimson red. Clypeus narrow, produced below genæ.

Metopidium very dark brown overlaid with black. Pronotum low, highest at mid-dorsal translucent spot, the anterior border of which slopes almost parallel with anterior oblique vitta; color dark red, including tip. Anterior vitta angulated caudad at its middle, broad, dull white, broadly bordered in front and behind with black, as is the broad, white and vertical anteapical vitta.

Body beneath black.

Fore wings far exceeding pronotum, dark smoky, very broadly and darkly infuscated at apex, the cloud covering terminal areole and half of adjacent cells.

Legs pale, femora above black.

Length 5.50 mm.

Allotype ♂. Litchfield, Conn. VI/9/'21. In my collection. Taken on *Quercus alba*.

shoulders are quite conspicuous and constant, and offer a good diagnostic mark.

*Cyrtolobus flavolatus* new species.

Only four specimens of the following very distinct little species have been seen by me, three taken by Mrs. A. T. Slosson in Pennsylvania, and one by Mr. Davis on Long Island, N. Y. It is a small reddish brown and yellow form, with low pronotum, strongly suggesting in its markings *Ophiderma flaviccephala* Goding, but in structure a member of this genus. Figures of both sexes are appended hereto, and their description follows:

*Cyrtolobus flavolatus*, new species. (Plate V, Figs. 37, 38.)

FEMALE: Face pale yellow, broader between eyes than long, clypeal sutures distinct, clypeus convex between loræ and produced below.

Pronotum low, sparsely hairy; carina on metopidium distinct, rising very moderately from anterior sinus, highest about middle, sloping evenly to apex, which barely reaches as far back as basal angle of terminal areole of fore wings. Mid-dorsal compression rather deep. Color light reddish brown, with yellow distributed as follows: Base of metopidium narrowly margined with yellow, this color rising at its middle in a band as broad as distance between ocelli to its summit, and extending over humeri in broad and slightly widening bands along lateral margins two-thirds the length of pronotum, their apical extremities arcuated abruptly from just below mid-dorsal compression to lateral margins. The usual anteapical vitta also yellow, narrow, descending slightly caudad. No trace of an anterior oblique vitta.

Body beneath pale yellow.

Fore wings reddish at extreme base, narrowly pale fuscous at terminal margin, the fuscous cloud slightly invading apical cells, veins pale testaceous. Otherwise hyaline.

Legs pale yellow.

Length 5.5 mm.

MALE: Like the female, but even more depressed; colors brighter, more sharply contrasted.

Pronotum a darker reddish brown, marked with yellow as in female, the callosities on metopidium above eyes conspicuously black.

Body beneath, and apex of clypeus and loræ, black.

Fore wings like those of female, but veins and cloud much darker, the fuscous margin covering about half of terminal areole.

Legs pale, fore femora above a little brownish.

Length 5. mm.

Holotype ♀. Delaware Water Gap, Penn. VII/1/—(Mrs. Slosson). In collection of Mrs. A. T. Slosson.

Allotype ♂. Same locality. No date label. (Mrs. Slosson.) Also in Slosson collection.

Paratype ♂. Same locality. No date label. (Mrs. Slosson.) in my collection, and ♀ from Half Way Hollow Hills, Long Island, N. Y. VII/2/15. (W. T. Davis.)

The depressed form of this species, particularly in the male, suggests the genus *Ophiderma*, but the strong carination and the compression of the pronotum posteriorly characterize it as a *Cyrtolobus*. Although I have sought for it in the type locality, as well as in the exceedingly large amount of material which has passed through my hands, the above specimens are all that I have seen. The female (holotype) bore the label "*Cyrtolobus lateralis* V. D. var.?" But it is not close to *lateralis* Van Duzee. While marked somewhat as in that species, these specimens are hardly a quarter of its size in bulk, and the fore wings are clear, while those of *lateralis* are conspicuously clouded throughout with dark smoky. Besides, *lateralis* was assigned by Van Duzee to *Xantholobus*, in which sub-genus I think it belongs, whereas this little species is excluded from that sub-genus by the lack of bulbous inflations fore and aft of the mid-dorsal compression, the pronotum tapering evenly to apex with hardly a suggestion of cysts. It is unquestionably entitled to specific recognition.

*Cyrtolobus incrimis* Emmons.

This is here referred to for the purpose of calling attention to the fact that there seem to be two color forms of the male—the polished black one, described by Van Duzee in his "Studies", and a light brown one with like white vittæ. There is also apt to be present in both black and brown forms a small mid-dorsal translucent spot. It is just possible that the black form indicates greater maturity; but of that there is no evidence. Apparently these color phases parallel those in the male of *C. ovatus* Van D., before referred to.

*Cyrtolobus (Atymna) simplex* Van Duzee.

So far as known to me, the male of this species has not yet been found and recorded. Its habitat is in our southwestern

states, and a report of the capture of a copulating pair is very desirable, that this gap in our knowledge of the group may be definitely filled.

*Cyrtolobus (Atymna) castaneæ* Fitch.

This opportunity is availed of to record my conviction, based upon material which I have collected, that *viridis* Emmons as described and figured by him, and which still holds a place in our List, is certainly one of the color forms of *castaneæ* Fitch, as has been suggested by other authors. With the practical annihilation of our chestnut trees the future persistence of this species is problematical, although it does at times subsist on oaks.

*Cyrtolobus (Atymna) helena* Woodruff.

This species, described in the Journal of the New York Entomological Society, XXIII, p. 44, Plate IV (1915), was found in comparative abundance on *Quercus platanooides (bicolor)* at Bronxville, N. Y. Although still to be found on its host plant at that locality, no example that has been taken elsewhere has been seen by me except from New Jersey, and the following two: A male taken by Dr. H. H. Knight in Ramsey Co., Minn., July 20, 1920, and a female, also taken by him at Faribault, Minn., June 12, 1922. These two specimens are typical, having been compared by me with holotype and allotype respectively, except that the female has very interesting sub-obsolete indications on the crest of the dark markings of the male; and their capture in a State so far distant from their type locality makes it probable that the species will subsequently be found upon its favored host plant throughout our northeastern states.

It has been suggested that this species does not belong in *Atymna*, the summit of the crest being back of the humeri as in *Cyrtolobus s. str.* Notwithstanding the force of that suggestion, I still regard its position in the genus as very close to *Atymna querci* Fitch, with the two sexes of which it closely corresponds in general coloring and form. It may be pointed out that, except in *Atymna castaneæ*, the form of the pronotal arch of the female in the several species generally assigned to this sub-genus in order to indicate their affinities in the group, tends to conform with that

found in *Cyrtolobus* proper; the females of all of the species so assigned being green and without pattern, though in *castaneæ* ranging from that color to almost black. The slightly more rearward summit of the pronotum in the male of *helena* is in my opinion not sufficiently important to warrant the ignoring of the many other correspondences which point to its alignment in classification with the special group which includes *A. querci* Fitch.

*Cyrtolobus (Atymna) querci* Fitch.

In this common species color variation in the males is of frequent occurrence. Copulating examples of this sex in some sections are regularly pink and yellow, instead of the more typical black and yellow; the pattern, however, continuing normal.

*Cyrtolobus (Atymna) inornata* Say.

This distinct little species, one of the first in the genus to be described, is remarkable in having the two sexes alike in coloring, both green. No satisfactory character has yet been pointed out for distinguishing the female from the corresponding sex of *querci* Fitch, and though it most probably averages smaller, I suspect that the two species are commonly confused in collections, including my own, except in those cases where the females have been taken in copulation.

*Cyrtolobus (Evashmedea) concinnus* Goding.

This dorsally sinuate and elongate species is another of our southwestern forms, concerning which there seems to be no confusion.

*Cyrtolobus (Xantholobus) muticus* Fab.

This is a widespread species of our eastern and southern states, which is generally recognized. No occasion for its discussion here is present.

*Cyrtolobus (Xantholobus) lateralis* Van Duzee.

The species *Cyrtolobus (Xantholobus) lateralis* Van Duzee was based upon one female taken at Ithaca, N. Y., and well described in the "Studies" (ante). As the male has not been recognized in



the literature, a figure of an example of that sex is here presented, together with a description.

**Cyrtolobus** (*Xantholobus*) **lateralis** Van Duzee. (Plate VI, Fig. 50.)

MALE: In form like the female, but a little smaller, the swollen posterior cyst very characteristic.

Face black, heavily marked with yellowish testaceous, including clypeus above its inflexed process.

Pronotum jet black, base of metopidium yellowish testaceous, lateral margins to below posterior cyst, as in the described female, and broad vertical anteapical vitta, testaceous white.

Body beneath black.

Fore wings on basal half and broadly at apex dark fuscous, including veins; otherwise smoky hyaline, not nearly so enfumed as in the female.

Legs pale, femora above black.

Length 5.75 mm.

Allotype ♂. Litchfield, Conn. VI/22/'22. Taken on *Quercus alba*. In my collection.

I have taken but one other male, in the same locality, which is the counterpart of the one above described. A considerable series of females shows a gradation in pronotal coloring from pale rufous brown to very deep mahogany red, almost black, and a frequent abbreviation of the pale lateral margin to a narrow border not extending rearward beyond the post-humeral sinus, and occasionally wholly obsolete. The anteapical vitta, present in the male, is lacking in the female. The body beneath in that sex is much the color of the pronotum; but the abdominal segments are pale except the elongated ninth (either side of styles of ovipositor), which is light rufous, as are the legs, including femora. In the "Fitch material" at the National Museum is a female of this species impaled on a short ordinary pin with a number label 3112 underlined in red ink, and a narrow name label reading *C. nigripennis*. So far as I can discover there has been no publication under this name, in which case Van Duzee's name for this species is valid.

*Cyrtolobus* (*Xantholobus*) *inflatus* Van Duzee.

The male of this species has not yet been described, but it is known, and I understand that the description is presently forthcoming. It is another inhabitant of our southwestern states.

*Cyrtolobus (Xantholobus) tumidus* Walker.

Of this species I have no personal knowledge. It was described from Florida, and Dr. Funkhouser reports it from Mississippi also.

*Cyrtolobus (Xantholobus) nitidus* Van Duzee.

The species *Cyrtolobus (Xantholobus) nitidus* Van Duzee was based upon three females, one taken at Lakehurst, New Jersey, and although assiduous collecting in the type locality has been done in an endeavor to discover the male, it has resulted only in the acquisition of a few more females, most of which were taken on *Quercus ilicifolia*. They are substantially counterparts of the co-type taken on Staten Island, N. Y. by Mr. W. T. Davis. What is undoubtedly the male of this species, however, is a black specimen which is described below and figured herewith, taken by Mr. Chris E. Olsen on the south shore of Long Island, N. Y., the insect fauna of which region has a decidedly southern cast. A figure of the above co-type, now in the collection of the American Museum of Natural History through the generosity of Mr. Davis, is herewith presented on Plate V, Fig. 40, and the male above referred to is also figured in Fig. 39 of that plate.

***Cyrtolobus (Xantholobus) nitidus* Van Duzee. Plate V, Figs. 39, 40.-**

**MALE:** Black, low, shining, coarsely hairy, with the posterior swelling of pronotum characteristic of the sub-genus.

Face black, shining, coarsely and densely punctured, a narrow and sharp median channel from apex to clypeus, the latter strongly deflexed; a mahogany red spot at margin above each ocellus.

Pronotum black, shining, coarsely punctured, the metopidium depressed callosities lacking, but in their place smooth shining mahogany red spaces above inner corner of each eye. Mid-dorsal compression strong without translucent spot, succeeded below, and posteriorly by a pronounced bulbous swelling. Anteapical vitta white, vertical, crossing pronotum just before apex, the latter black, blunt, not reaching triangular base of terminal areole of fore wings.

Body beneath black anteriorly and on sides of abdominal segments. Otherwise pale testaceous.

Fore wings hyaline, their veins flavous, without terminal cloud, but basal three-fifths very heavily infuscated with blackish mahogany.

Legs testaceous white, the spines of posterior tibiae and tarsi black. Length 3.5 mm.

Allotype ♂. Bay Shore, Long Island, N. Y. VII/4-7/'12 (C. E. Olsen), in my collection.

This species is not often met with, and except for those from Lakehurst, N. J. I have seen but one female, collected at Bay Shore, Long Island, where the above male was taken, and another collected at Clayton, Georgia.

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As must have been inevitable in the consideration of so difficult and confused a genus as the one under discussion, there are before me many forms which seem to be distinct and undescribed, but by reason of lack of adequate material or other cause impelling caution in determining their specific status, they are not assigned definitely for the present, and so are not considered in this paper. I have no doubt that several of them represent unrecognized species, and from my own experience think it probable that intensive collecting throughout our area will disclose many more forms hitherto undescribed.

In this group the female usually bears the more distinctive pattern, and for that reason, as well as the fact that that sex is ordinarily much the more abundant and long-lived, the several species are almost always founded upon a female specimen. Furthermore, as the males are apt to be very differently colored from the females with which they are properly associated, and at the same time similarly colored as between themselves in the several species, it is often difficult to assign correctly a specimen in hand. This renders it most important to take pairs in copulation. Their breeding season is very brief, and such pairs are found only occasionally; the several species are very local in their habits not being widespread even in a locality where found on their particular host plant in comparative abundance; and aberrant color forms occur frequently which are puzzling to place. These facts, among others, make the task of preparing a competent and exhaustive review of the genus one that requires, in our present state of knowledge, much time and intensive field study over our whole area.

When a species is recorded as rare, it should perhaps be understood as meaning rarely found. It is quite possible that some of our rarities find the inaccessible upper branches of their host plant

more to their liking than the lower ones, thus escaping observation and capture.

In my citation of paratypes I have usually indicated only such specimens as have been taken in the type locality, though reference has been made to undoubted specimens of the species under consideration taken elsewhere that have come to my attention. An effort will be made to distribute paratypes of the new species here described and discussed, when available, among the more important representative collections in the country.

#### EXPLANATION OF PLATES I TO VI.

All figures are enlarged eight diameters.

##### PLATE I.

- Fig. 1. *Cyrtolobus vau* Say. Male.
- Fig. 2. *Cyrtolobus vau* Say. Female.
- Fig. 3. *Cyrtolobus arcuatus* Emmons. Male. Allotype.
- Fig. 4. *Cyrtolobus arcuatus* Emmons. Female.
- Fig. 5. *Cyrtolobus dixianus* Woodruff. Male. Allotype.
- Fig. 6. *Cyrtolobus dixianus* Woodruff. Female. Holotype.
- Fig. 7. *Cyrtolobus aureus* Woodruff. Male. Allotype.
- Fig. 8. *Cyrtolobus aureus* Woodruff. Female. Holotype.

##### PLATE II.

- Fig. 9. *Cyrtolobus celsus* Van Duzee. Male. Allotype.
- Fig. 10. *Cyrtolobus celsus* Van Duzee. Female.
- Fig. 11. *Cyrtolobus funkhouserii* Woodruff. Male. Allotype.
- Fig. 12. *Cyrtolobus funkhouserii* Woodruff. Female. Holotype.
- Fig. 13. *Cyrtolobus fuliginosus* Emmons. Male. Allotype.
- Fig. 14. *Cyrtolobus fuliginosus* Emmons. Female.
- Fig. 15. *Cyrtolobus clarus* Woodruff. Male. Allotype.
- Fig. 16. *Cyrtolobus clarus* Woodruff. Female. Holotype.

##### PLATE III.

- Fig. 17. *Cyrtolobus rufulus* Woodruff. Male.
- Fig. 18. *Cyrtolobus rufulus* Woodruff. Female.
- Fig. 19. *Cyrtolobus rufulus* Woodruff. Male. Allotype.
- Fig. 20. *Cyrtolobus rufulus* Woodruff. Female. Holotype.
- Fig. 21. *Cyrtolobus intermedium* Emmons. Male.
- Fig. 22. *Cyrtolobus intermedius* Emmons. Female.
- Fig. 23. *Cyrtolobus gratiosus* Woodruff. Male. Allotype.
- Fig. 24. *Cyrtolobus gratiosus* Woodruff. Female. Holotype.

## PLATE IV.

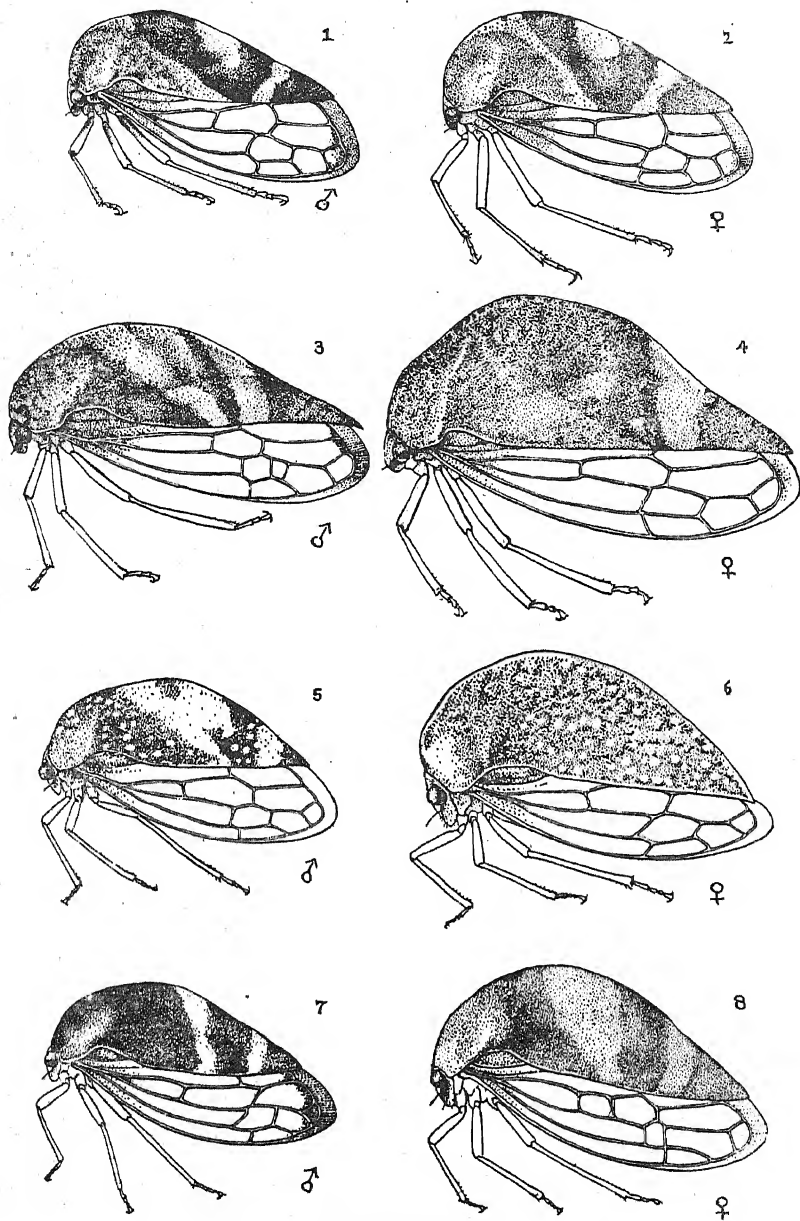
- Fig. 25. *Cyrtolobus pallidifrontis* Emmons. Male.  
Fig. 26. *Cyrtolobus pallidifrontis* Emmons. Female.  
Fig. 27. *Cyrtolobus gramatanus* Woodruff. Male. Allotype.  
Fig. 28. *Cyrtolobus gramatanus* Woodruff. Female. Holotype.  
Fig. 29. *Cyrtolobus pulchellus* Woodruff. Male. Allotype.  
Fig. 30. *Cyrtolobus pulchellus* Woodruff. Female. Holotype.  
Fig. 31. *Cyrtolobus parvulus* Woodruff. Male. Allotype.  
Fig. 32. *Cyrtolobus parvulus* Woodruff. Female. Holotype.

## PLATE V.

- Fig. 33. *Cyrtolobus puritanus* Woodruff. Male. Allotype.  
Fig. 34. *Cyrtolobus puritanus* Woodruff. Female. Holotype.  
Fig. 35. *Cyrtolobus togatus* Woodruff. Male. Allotype.  
Fig. 36. *Cyrtolobus togatus* Woodruff. Female. Holotype.  
Fig. 37. *Cyrtolobus flavolatus* Woodruff. Male. Allotype.  
Fig. 38. *Cyrtolobus flavolatus* Woodruff. Female. Holotype.  
Fig. 39. *Cyrtolobus nitidus* Van Duzee. Male. Allotype.  
Fig. 40. *Cyrtolobus nitidus* Van Duzee. Female. Holotype.  
Fig. 41. *Cyrtolobus ovatus* Van Duzee. Male. Allotype.  
Fig. 42. *Cyrtolobus maculifrontis* Emmons. Male.

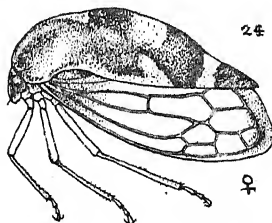
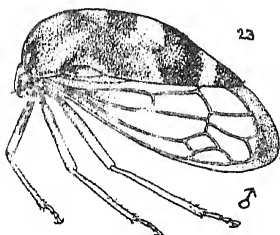
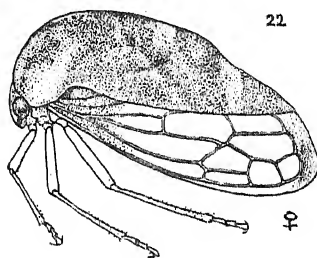
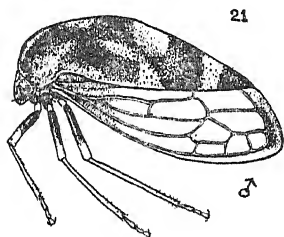
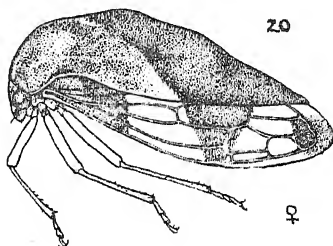
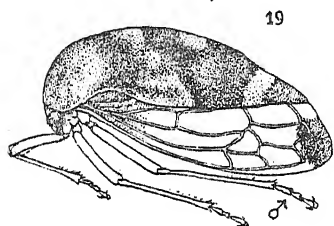
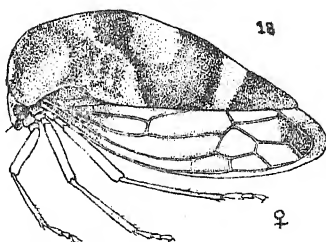
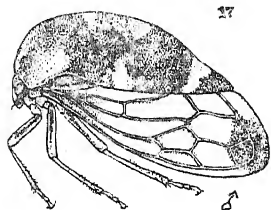
## PLATE VI.

- Fig. 43. *Cyrtolobus fenestratus* Fitch. Male.  
Fig. 44. *Cyrtolobus fenestratus* Fitch. Female.  
Fig. 45. *Cyrtolobus discoidalis* Emmons. Male. Allotype.  
Fig. 46. *Cyrtolobus discoidalis* Emmons. Female.  
Fig. 47. *Cyrtolobus acuminatus* Woodruff. Male. Allotype.  
Fig. 48. *Cyrtolobus acuminatus* Woodruff. Female. Holotype.  
Fig. 49. *Cyrtolobus fuscipennis* Van Duzee. Male. Allotype.  
Fig. 50. *Cyrtolobus lateralis* Van Duzee. Male. Allotype.



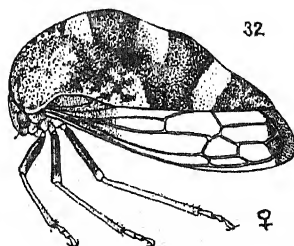
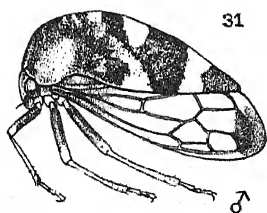
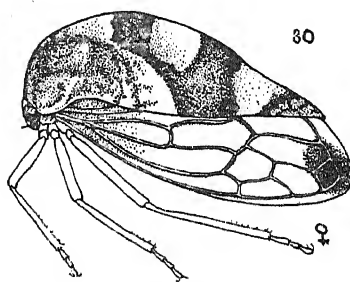
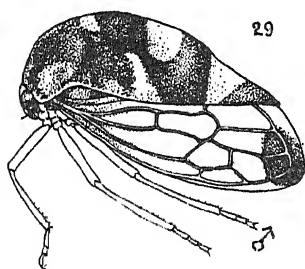
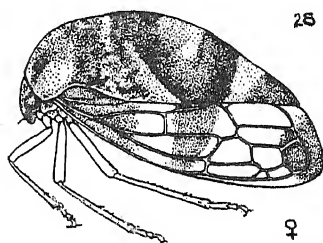
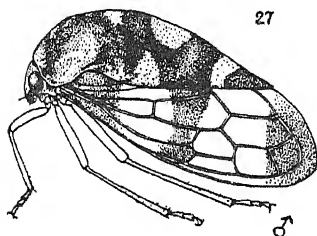
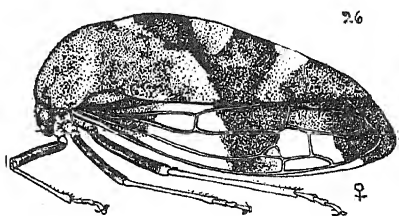
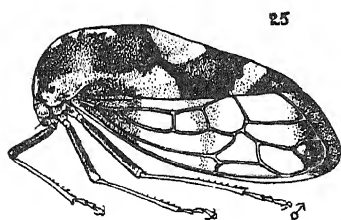
GYRTOLOBUS.





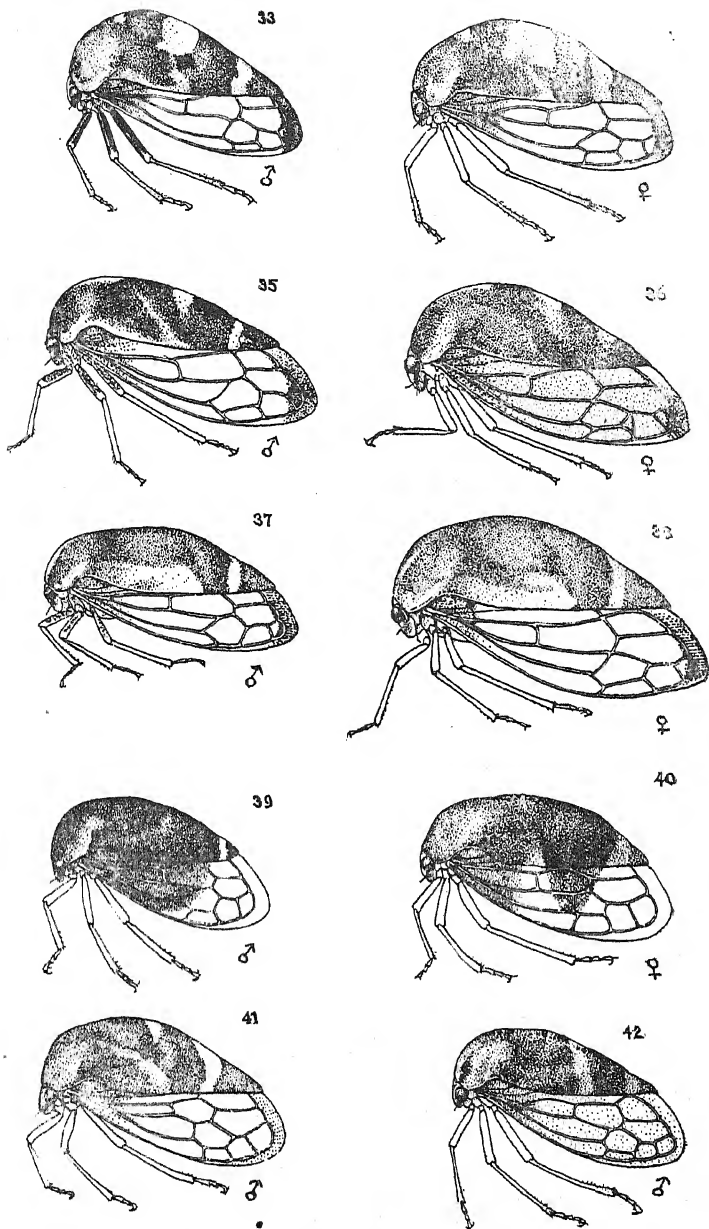






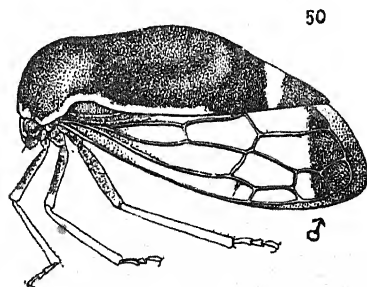
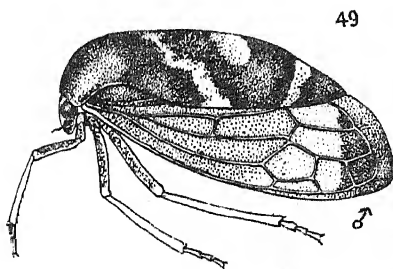
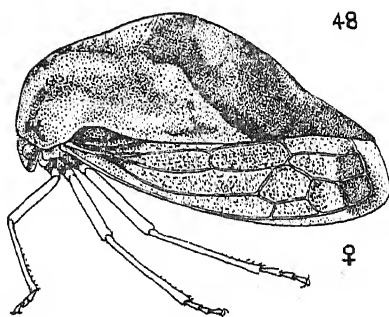
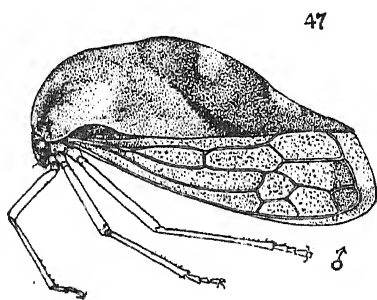
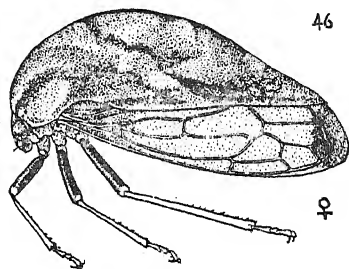
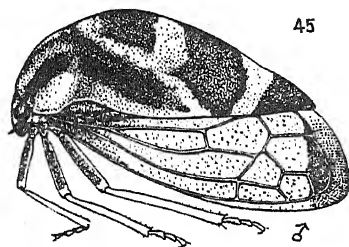
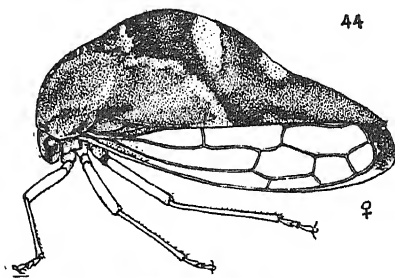
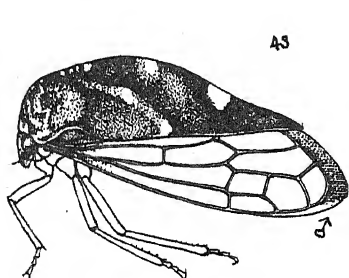
CYRTOLOBUS.





CYRTOLOBUS.





CYRTOLOBUS.



## SOME NEW CICADELLIDÆ (HOMOPTERA) FROM THE SOUTHERN UNITED STATES.

BY DWIGHT M. DELONG,

OHIO STATE UNIVERSITY, COLUMBUS, OHIO.

During the spring of 1921 several interesting species of "Jassids" were collected in the Florida everglades, many of which had not been previously described. This paper is the third one pertaining chiefly to these new forms, the previous articles were published in the Proceedings of the Biological Society of Washington during the past year (Sanders and DeLong).

### *Idiocerus taxodium* new species.

Resembling *nervatus* in general appearance and coloration but smaller and more robust, dark green with a bright iridescent tinge. Length, 3.5 to 4 mm.

Male antennal discs black, elongated, constricted basally and apically, and bearing a flagellum at apex which is almost twice as long as disc.

Color: Vertex, pronotum and scutellum dark green, basal angles of latter usually with a yellowish spot. Eyes bright red even in preserved material. Elytra subhyaline, with a bright bronze iridescent tinge, often smoky at tip, green of abdomen showing through. Sutural veins green. Face washed with yellow, venter green.

Genitalia: Female last ventral segment slightly roundly produced. Male valve with a roundly produced tooth at middle.

Described from a series of twenty-seven specimens collected at Paradise Key, Florida, April 5 and 10, 1921, by Mr. J. N. Knull and the author. All of these were swept from bald cypress, *Toxodium disticum*, trees and shrubs in the small hammocks of the everglades.

### *Deltocephalus eburneus* new species.

In general appearance and coloration resembling a *Scaphoideus* of the *sanctus* group but apparently most closely related to *D. simplex* and *osborni*. Length 4.5 mm.

Vertex very bluntly angled, almost one-fourth wider between eyes than length at middle, disc flat, rather sharply angled with front. Pronotum almost twice as broad as long, side margins very short. Scutellum large.



Elytra long. Clavus reticulate, central anteapical cell long, constricted and divided at center, enlarged posteriorly. Antennæ long.

COLOR: Face, clypeus and loræ heavily embrowned, with traces of pale arcs. Antennal pits black. Vertex white with four small spots above margin and a blotch on disc either side of middle pale orange. Pronotum with a median broad stripe and a narrowed one either side, brownish. Scutellum pale yellow, basal angles and apex darker. Elytra milky white, a large spot on middle of outer clavus dark brown, posterior claval cells washed with yellow. Inner anteapical cell, anterior and posterior portions of middle anteapical cell and outer apical cell pale to dark brown, this pattern forming a cross on the two elytra as in *Scaphoideus cruciatus*. Venter dark with yellow mottling, ovipositor black.

GENITALIA: Female last ventral segment almost three times as long as preceding. Posterior margin slightly narrower at base than preceding segment, lateral margins slightly rounding to prominent lateral angles, posterior margin shallowly concave.

Described from a single female specimen in excellent condition, collected at Corinth, Mississippi, July 8, 1921, and kindly sent to me by Dr. Carl J. Drake, the collector.

*Lonatura bicolor melleus* new variety.

Size and form of *bicolor* but with different coloration. Anterior margin of vertex black, a round spot at apex and ocelli yellowish. Disc yellow with five finger-like points projecting into the black area. One extending forward almost to apical spot, one either side in front of ocelli, and a second either side about midway along the eye. Pronotum, scutellum, elytra and abdomen yellow. Posterior margins of segments reddish, last dorsal segment black. Face beneath dark brown, paler below. Venter yellow to pale brown with darker markings.

This form occurs on the prairie grasses in company with typical *bicolor*. The color is almost entirely yellow instead of black as in that form.

*Thamnotettix perspicillata rubralineus* new variety.

Although this form is apparently only a variety of *perspicillata*, and the genital characters are practically the same, it is, nevertheless, slightly smaller in size and is more conspicuously colored. Length 3.4 mm.

It differs from *perspicillata* by having two rather broad bright red longitudinal bands which arise on the face just beneath the vertex and extend across vertex, pronotum and basal angles of scutellum. Also a short longitudinal band extends across the outer angles of the scutellum on either side. If the elytra and wings are removed these longitudinal stripes

are found to extend to the tip of the abdomen. This reddish color frequently shows through giving the elytra a red tinge. Three white circular spots are conspicuous on the clavus of each elytron along the commissural line.

Genitalia as in *perspicillata*.

The nymph was collected in abundance in the last three instars during April both at Miami, Florida, and La Belle, Florida. The nymphs are yellow in color with bright red eyes and a red band extends across the margin of vertex between them. It is slightly interrupted at the middle and terminates in a large black spot either side of apex. A pair of red longitudinal stripes fuse in this black spot either side and extend to the tip of abdomen. Also a pair extending across eyes or arising just behind them extends across pronotum and wing pads, when present, and along lateral margin of the abdomen either side, merging with the central pair at the tip of the abdomen.

The strikingly colored nymphs would seem to indicate a distinct species, but because of the similarity of the adults it is cited as a variety only.

Described from nine adults and a large number of nymphs. Collected at Miami, La Belle, Cleveland, and Orlando, Florida, during April, 1921, by the author.

#### ***Thamnotettix planus* new species.**

Resembling *T. fitchii* in form and coloration but with genital characters very similar to *aureovittatus*. Length 3-3.5 mm.

Vertex blunt anteriorly, a little wider between eyes than length at middle. Pronotum twice as wide as long, strongly convex anteriorly. Elytra rather long, much longer than abdomen.

Color: Somewhat variable, straw to buff, face unmarked, ocelli pale red. Vertex with four small black spots about equidistant from each other in a row just above margin between ocelli. Pronotum in some specimens with a faint suggestion of longitudinal stripes. Elytra with venation pale and conspicuous. Beneath buff.

Genitalia: Female last ventral segment one-half longer than preceding. Lateral margins short, gradually produced to form a conspicuous rounded lobe either side of broad sunken truncated or slightly produced portion which is heavily embrowned and occupies the median third of the segment. Portions of underlying membrane rather large, conspicuous and produced beyond the posterior margin at either side. Male valve slightly produced, scarcely angled almost contained within the concavity of the last ventral segment. Plates short and broad, two-thirds as long as combined width at base. Convexly rounded from base to rather blunt tips. Pygofer much longer than plates, cedeagus exceeding plates, bifurcate at apex.

Described from a series of specimens collected by the author at Miami, Florida, April 1 to 14, 1921, La Belle, Florida, April 20, 1921, and Sanibel Id., Florida, April 28, 1921, swept from grasses in dry upland areas. It does not occur in the sawgrass habitat and can easily be distinguished from *aureovittatus* by the different coloration, more flattened vertex, less tumid face and the more sharply angled front and vertex. Also the oedagus of the male genitalia is different.

***Chlorotettix floridanus* new species.**

Resembling *galbanatus* in size and general appearance with vertex more rounded and genitalia different. Length 6 mm.

Vertex bluntly rounded, a little longer at middle than next the eyes and more than twice wider between eyes than length at middle. Pronotum more than twice as long as vertex. Elytra long, greatly exceeding abdomen.

Color bright green with a brownish iridescent tinge especially on elytra. Often washed with yellow.

Genitalia: Female last ventral segment twice as long as preceding, lateral margins roundly produced from half their length to form a broad rounding lobe either side of a broad median somewhat U-shaped notch extending two-thirds the distance to base. The sides of the notch convexly rounded almost to apex where an abrupt broad V-shaped notch is formed. Notch at base broadly embrowned. Male valve almost twice as long as preceding segment, more than twice wider than long, almost rounded at apex. Plates exceeding valve by more than twice its length, gradually sloping almost to apex where they are convexly rounded to form rather blunt appressed apices. Plates are longer and narrower than in *galbanatus*.

Described from four female specimens and one male all from Florida. Collected by the author. One female from Ft. Myers was collected April 22, 1921, and the other specimens were secured at Paradise Key, April 4 and 9, 1921.

***Neocœlidia tumidifrons vittapennis* new variety.**

Agreeing with typical *tumidifrons* in size and form but with elytra distinctly and conspicuously marked.

Pale to bright green, vertex and pronotum unmarked. Scutellum with the two round black spots in the basal angles. Elytra marked with brown vittæ which follow for the most part the wing venation. A stripe just inside the costal margin, a rather broad stripe along the commissural line and the veins of the wings brown, often broadly margined with brown. Sometimes the tips of the elytra are dark brown, smoky.

Described from a large series of specimens from Paradise Key, Ft. Myers, Orlando, La Belle and Miami, Florida. Collected during April, 1921. They live on short grasses in open pineland.

*Cicadula scriptus* new species.

A very minute species resembling *sexnotata* in coloration but much smaller and with distinct markings. Length 2-2.5 mm.

Vertex arcuately produced, rather broadly rounded, about one and one-half times as wide between eyes as length at middle. Pronotum less than twice as long as vertex and twice wider than long. Elytra when folded causing insect to appear wedge shaped.

Color: Yellow washed with green, margin of vertex along eyes black, a band across vertex just above ocelli seldom broken, and a much broader one just below ocelli, sometimes interrupted at middle, black. A round black spot about the middle either side at base. Pronotum with a pair of approximate black spots near anterior margin and vermiculate markings anteriorly. A pair of approximate round spots at base of scutellum, basal angles and median impressed line black. Elytra smoky green, nervures pale. Sutures between face, clypeus and loræ, a longitudinal stripe across face and clypeus, broken arcs on face and outer margins of loræ dark brown. Beneath yellow, ovipositor black.

Genitalia: Female last ventral segment about as long as preceding, lateral angles slightly produced, posterior margin broadly, shallowly excavated. Ovipositor black. Male valve triangular, apex rounded. Plates exceeding valve by its length, broad at base, gradually tapered to narrowed upturned tips.

Described from a large series collected at Cleveland, Florida, April 25, 1921, by the author. Great numbers of both nymphs and adults were taken from *Eleocharis ochreatea* (Steud) which was growing in a low marshy area where a lagoon had formerly been.

*Diktaneura unipuncta dorsalis*, new variety.

Agreeing with *unipuncta* in size and form but with different coloration

Disc of vertex and pronotum, scutellum and clavus of elytra covered with a broad longitudinal brownish band which is bordered by a white band extending along margins of vertex from apex, across margins of pronotum on to elytra at base and along claval suture half way to apex. Remainder of clavus brownish. Apical cross veins pale, fuscous margined, and black spot on apex as in *unipuncta*. Face yellowish.

This is a very common variety found in the everglades in company with *unipuncta* and is extremely abundant upon *Trima floridana* in everglade hammocks which are composed partially or entirely of this plant.

***Dikraneura marginatus* new species.**

In form and general appearance resembling *D. kunzei* but darker in color and with distinct genitalia. Length 2-2.5 mm.

Vertex produced, apex rounded, slightly wider between eyes than length at middle. Pronotum one-third longer than vertex, not twice as wide as long. Elytra with outer cell lanceolate. Venation differing from *kunzei*.

Color: Vertex dull yellow tinged with brown, median impressed line and a line just above margin and parallel with it, brownish. Margin below this line pale yellow with a narrow brownish line slightly below middle not extending to eyes. Face below brown, without traces of arcs. Pronotum with anterior third dull yellowish, disc and posterior portion sordid green. Scutellum dark green, apical third paler. Elytra sordid green tinged with yellow. Apical portion paler, venation yellowish. Tergum; black, venter dark brown marked with yellow.

Genitalia: Female last ventral segment longer than preceding, posterior margin gradually produced and somewhat convexly rounded. Male valve short, broadly rounded, almost contained within the concavity of last ventral segment. Plates three times as long as width at base, gradually narrowed from base and produced into long attenuated apices.

Described from one female and two male specimens collected at Miami, Florida, April 2 and 3, 1921.

***Empoa minutus* new species.**

A very minute species resembling a *Dikraneura* in general appearance, but with typical *Empoa* wing venation. Length 2 mm.

Vertex rounded, strongly produced, about one-fourth wider between eyes than length at middle. Pronotum one-fourth longer than vertex, not twice as wide as long. Elytra twice as long as abdomen in male. Outer veins of elytra united, then branching to form a triangular cell.

Color white to yellow, with a pair of longitudinal yellowish bands extending across vertex next eyes and across pronotum to scutellum. Basal half of elytra yellowish, claval vein and commissural suture white. Posterior half smoky, veins yellowish.

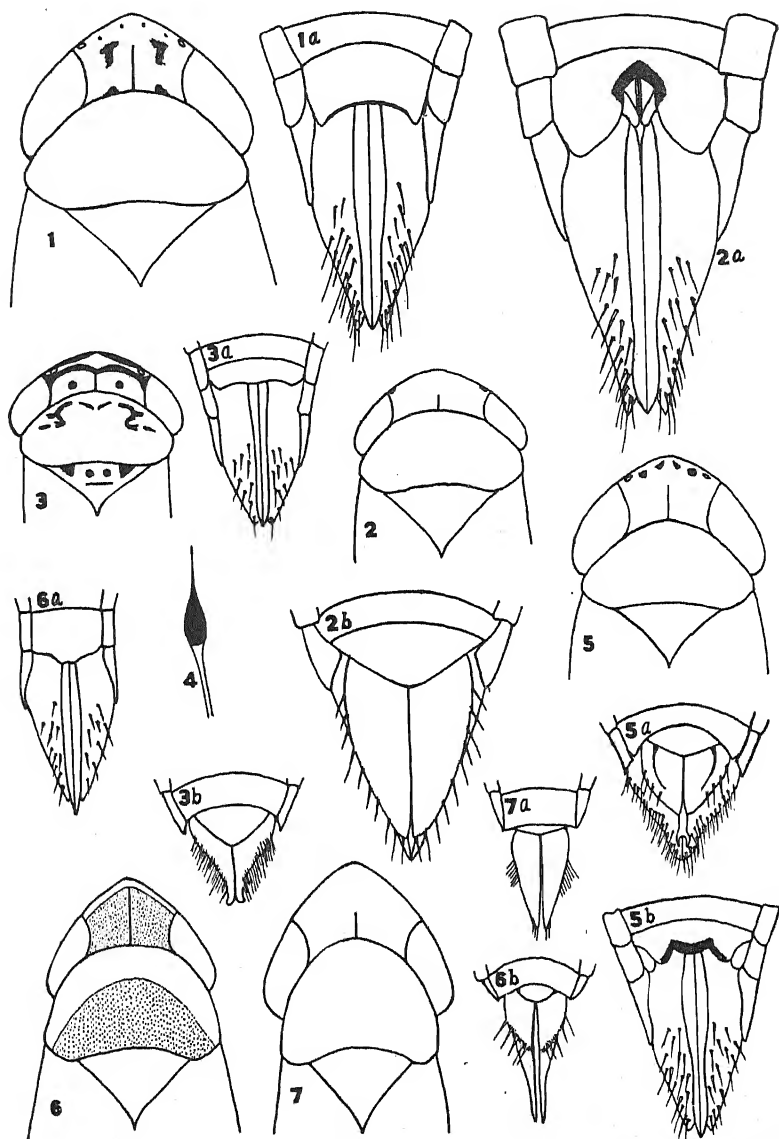
Genitalia: Male valve rather short and truncate or nearly so. Plates long, rather broad at base, gradually narrowed to rather blunt pointed apices.

Described from a single male specimen collected at Miami, Florida, April 13, 1921, by the author.

## EXPLANATION OF PLATE VII.

1. *Deltocephalus eburneus* n. sp.; 1a—female genitalia.
2. *Chlorotettix floridanus* n. sp.; 2a female genitalia; 2b—male genitalia.
3. *Cicadula scriptus* n. sp.; 3a—female genitalia; 3b—male genitalia.
4. *Idiocerus taxodium* n. sp. (antennal disc).
5. *Thamnotettix planus* n. sp.; 5a—male genitalia; 5b—female genitalia.
6. *Dikraneura marginatus* n. sp.; 6a—female genitalia; 6b—male genitalia.
7. *Empoia minutus* n. sp.; 7a—male genitalia.





CICADELLIDAE.





A NEW XANTHOLINID SWARMING ON GRAVE-  
STONES ON STATEN ISLAND AND A NEW  
TROGOPHLÆUS (COLEOPTERA:  
STAPHYLINIDÆ).

By HOWARD NOTMAN,

BROOKLYN, N. Y.

*Trogophlæus weissi* new species.

Form moderately slender and rather depressed, much broader posteriorly, the fifth abdominal segment being the widest part of the body. Color black, legs, mouth parts and antennæ piceous black; first antennal joint paler, rufopiceous. Integuments moderately shining. Punctures on head, thorax and elytra rather coarse, those on the elytra much coarser and somewhat sparser, separated by about their own diameters. Abdomen very finely and sparsely punctured, rather strongly microreticulate. Head slightly transverse, about a fifth wider than long, very slightly wider than the thorax, the eyes small and rather feebly convex, the tempora distinctly longer and more prominent, strongly rounded; antennæ short, about as long as the head and thorax, very feebly incrassate but rather thick, the ninth and tenth joints about one-fourth wider than long. Thorax rather more than five-sixths as wide as the elytra and one-half wider than long, base and apex nearly equal with the sides rather feebly arcuate, the disk strongly bi-impressed, the impressions not transversely interrupted. Elytra one-half wider than long and one-third longer than the thorax, the sides rather strongly divergent posteriorly, the disk strongly impressed along the suture. One specimen.

Length 2 mm., width 5 mm.

Type, Middlesex Co., N. J. VIII-23. (H. B. Weiss).

This species is very distinct by its large tempora, strongly bi-impressed thorax with the base and apex nearly equal, strongly transverse elytra with strongly divergent sides and the large abdomen. It may be placed near *T. agonus* Csy, but it seems to be related to *T. egregius* Csy also, though the punctuation is perhaps rather finer and denser. It certainly differs widely in this respect from a specimen of *T. phlæoporinus* in the author's collection. The author takes pleasure in naming it in honor of Mr. Harry B. Weiss, from whom it was received.

***Gyrohypnus (Hypnogyra) davisi* new species.**

Form slender, parallel. Color bright rufo-testaceous, head and elytra deep black. Integuments shining; head beneath finely strigillate; tempora convex and impunctate. Head as wide and as long as the thorax, a third longer than wide, sides subparallel, neck slightly more than one-half the width; punctures moderately coarse and sparse. Thorax with the sides parallel or slightly convergent posteriorly; the discal series of punctures composed of four; the posterior distant one-third the length from the base. Elytra very distinctly wider and longer than the thorax, disk with coarse, sparse punctures arranged in three more or less distinct series. Abdomen very finely and sparsely punctured, finely micro-reticulate. Thirteen specimens.

Length 4.25-5 mm, width .75-.9 mm.

Type and paratypes, Richmond, S. I., N. Y., Aug. 31, 1923 (Wm. T. Davis), and Lakehurst, N. J., 7, 30, 1922 (F. M. Schott). Collection H. Notman.

Paratype, Richmond, S. I., N. Y., Aug. 31, 1923 (Wm. T. Davis). Collection of the American Museum of Natural History, New York, N. Y.

Paratypes, Richmond, S. I., N. Y., Aug. 31, 1923 and Sept. 28, 1923 (Wm. T. Davis). Collection Wm. T. Davis.

This species is very distinct by its coloration and rather large elytra.

Mr. Wm. T. Davis, in whose honor the author takes pleasure in naming it, gives the following interesting account of the circumstances of its capture:

"This small beetle was observed in considerable numbers on the tops of several gravestones at St. Andrew's Church, Richmond, Staten Island, N. Y., on August 31, 1923. They were running about, often in circles, in a most excited manner, quite unusual among beetles, and reminding one more of the actions of ants. On September 28, a warm day, the beetles again appeared on the tops of several gravestones, but they were not as numerous as on the first occasion."

## MISCELLANEOUS NOTES.

On the Generic Position of *Asilus cacopilogus* Hine (*Asilidae*)<sup>1</sup>: During the study of the *Asilinæ* in the Canadian National Collection it seemed desirable that some character other than wing venation be found in order that at least one or more genera might be more readily separated from the remainder. With this object in view a careful examination of the thoracic sclerites was made and I was able to segregate all species of *Asilus* at once by an examination of the metanotum. This sclerite exhibits rather marked diversity in length and shape in several groups. In all the genera of *Asilinæ* which resemble *Asilus* in shape the metanotum is entirely bare or with only very short pubescence, but in *Asilus* it is hairy posteriorly except in the middle. The amount of hair varies somewhat but it is always quite conspicuous and readily seen from the side, where it is usually most abundant.

When I first made use of the character I must not have examined *Asilus cacopilogus* Hine, as I did not find an exception to the rule until making some determinations recently. This species is certainly not an *Asilus*, but must be placed in the genus *Erax*. It comes into the group *E. æstuanus* L. This disposition is a quite natural one from the point of wing venation as the posterior branch of the third vein, which is curved backwards at its apex, would run into the tip of the wing but for the curve. There is also, in many specimens, an indication of a stump of vein or evident angulation at the bend in the anterior branch of the third vein.

I have not seen typical specimens of *Asilus leucopogon* Williston, so am unable to pronounce upon the generic position of that species.—C. HOWARD CURRAN.

Parasitic Hymenoptera from New Jersey: Three of the following species do not appear to be listed in Smith's "Insects of New Jersey", and for this reason it was thought desirable to place them on record. The first three species were identified by Mr. A. B. Gahan.

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<sup>1</sup> Contribution from the Division of Systematic Entomology, Entomological Branch, Dept of Agric., Ottawa.

*Apanteles pyraustæ* Vier. Bred from the larvæ of *Pyrausta futilalis* on dogbane, New Brunswick, N. J., August 10.

*Sympiesis pennsylvanicus* Gir. Bred from the larvæ of *Cop-  
todisca kalmiella* Dietz, Browns Mills, N. J., June 22.

*Meteorus indigator* Riley. Bred from the larvæ of *Pyrausta futilalis* on dogbane, New Brunswick, N. J., August 10.

In a letter dated April 15, 1918, Dr. E. P. Felt informed me that he had reared a specimen of *Metopius pollinctorius* Say from a luna moth cocoon found on nursery stock which had been shipped to Rochester, N. Y., from Elizabeth, N. J.—HARRY B. WEISS.

## PROCEEDINGS OF THE NEW YORK ENTOMOLOGICAL SOCIETY.

### MEETING OF APRIL 19.

A regular meeting of the New York Entomological Society was held at 8 P. M., on April 17th, 1923, at the American Museum of Natural History; President Harry B. Weiss in the chair, with fourteen members and one visitor, Mr. C. W. Woodworth, Director Bureau of Entomology, Nanking, China, present.

Mr. Erdman West, New Jersey Department of Agriculture, Trenton, N. J., was elected a member. Dr. Henry Fox and Mr. J. J. Davis were proposed for membership by Mr. Weiss.

Mr. Davis spoke of the lecture given in Philadelphia by Dr. Bequaert, of the loss by Dr. Southwick of his slides, and exhibited a new map of the United States, from the National Geographic Magazine, pointing out how plainly certain faunal divisions were shown.

Mr. Mutchler exhibited two boxes of *Saperda* and *Oberea* and discussed the taxonomy, pointing out especially how *Oberea discoidea* Horn 1878 had been overlooked in all the catalogues including Leng's.

Mr. Weiss discussed the life history of the species found in New Jersey, referring to the work of Felt and Joutel on *Saperda*, and of Brooks, as the best since their time.

Mr. Bischoff added *Saperda moesta* to the list—which will later be printed.

Mr. Notman exhibited "Beetles from the Mohawk Valley." He said that he had collected near Fort Hunter from May 31st to June 6th, 1921, on broad gravel beaches and in pools in which water beetles abounded and had obtained some species of interest as indicating limits of distribution. *Bembidion planum*, *versutum* and *canadense*, *Clivina*, *Deronectes catascopium* and *Paria canella* were among the species referred to.

Dr. Leonard said he had been appointed acting State Entomologist while Dr. Felt gave his entire attention to the Gypsy Moth Barrier Zone and contemplated completing the New York State List of Insects, which matter was then discussed by many members.

Mr. Woodworth gave an interesting account of his efforts to train the Chinese at Nanking in economic entomology, particularly in exterminating flies and mosquitoes and thus reducing the deaths from typhoid, cholera and malaria. Twenty-seven men were used in continuous inspection of possible breeding places, dipping the mosquito larvæ out of the pools and destroying the fly larvæ by sprinkling with cyanide solution. The control attained was successful in greatly reducing death and disease. The control of locusts and of silk worm diseases was also in progress.

Mr. J. W. Angell spoke of spiders attacking flies at Ipswich, Mass.

## MEETING OF MAY 1.

A regular meeting of the New York Entomological Society was held at the American Museum of Natural History at 8 P. M. on May 1, 1923. President Harry B. Weiss in the chair with 15 members present.

The following were elected active members:

Dr. Henry Fox, Mercer University, Macon, Georgia.

Mr. J. J. Davis, Indiana Agricultural Experiment Station, Lafayette, Indiana.

Mr. Hallinan spoke on "Insects as Food of certain Panama Birds" giving the result of his examination of the stomachs of 440 birds of 159 species. Of these 60 seemed to have fed on insects only and 21 more partly on insects, but among these there was only one moth and Mr. Hallinan said he never saw a bird chasing a butterfly. There were numerous instances in which the habits of the birds in Panama differed from those they had northward.

His remarks were discussed by Messrs. Davis, Lutz, Angell and Shoemaker, the latter asking about catching *Morphos* which Mr. Hallinan said was done by putting sugar cane on the trail with a big net to intercept the butterflies.

Mr. Bischoff exhibited his collection of "Beetles of the tribe *Cryptcephalini*," including four species, recently described by H. C. Fall, new to the New Jersey list.

Mr. Dickerson exhibited some insects found in unexpected places including a bed bug from a can of salmon, a roach parasite (*Evania* sp.) found on a window in Newark August 14, a Ptinid beetle (*Mezium americanum*) from a bowl of sugar, and a *Vespa crabro* from a summer porch.

Several members contributed roach stories, ending with a recommendation that molasses in warm countries be poured through a fine screen to remove their legs.

Mr. Davis spoke of the coming of brood XIV of 17-year locusts to Long Island in 1923. He said that six of the known broods occurred on Long Island but only two on Staten Island. The Long Island dates had been:

Brood	I last in 1910
"	II " " 1911
"	V " " 1914
"	IX " " 1918
"	X " " 1919

" XIV " " 1916 which would bring it due again this year. He also pointed out that while their season was June and any other month had been ridiculed yet an occurrence in October had been twice confirmed.

Mr. Mutchler spoke of a megaphone for insect sounds illustrated in Popular Mechanics.

Mr. Bischoff spoke of the curious inability of non-entomologists to see 17-year cicadas.

Mr. Sherman gave some interesting data as to auction value of Entomologists' autograph letters, e.g., Hagen, 75c, Leconte 75c, Scudder \$1.50, etc.

Mr. Davis recorded April 20 at Rossville, Staten Island, as the first date in 1923 for the little blue butterfly, the season being late.

Mr. Bell confirmed this from his experience at Flushing, New Jersey, April 29, when few butterflies were seen.





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### NOTES ON THE LIFE HISTORY OF PRIONOCYPHON LIMBATUS LEC. (HELODIDÆ, COLEOPTERA)

BY HENRY G. GOOD,

DEPARTMENT OF ENTOMOLOGY, CORNELL UNIVERSITY.

Early in the spring of 1922, while on a field trip to Ringwood Hollow, about eight miles from Ithaca, N. Y., many larvæ of a beetle were found in a pool close to the shore as well as on the bank. The adults of the beetle were unknown but were thought to belong to the family *Dasyllidæ*. The writer became interested in the larvæ and attempted to rear them in the laboratory. The larvæ were placed into a rectangular aquarium to which dirt and leaves from the pool were added at one end. The aquarium was then partially filled with water so that about half of the dirt was left exposed, above the surface of the water.

In their natural habitat, the larvæ live in still water, very near the shore, and then only where leaves are found on the surface. The larvæ are most abundant where the leaves are old and partially decomposed, for they feed on the broken-down epidermal cells of such leaves. This conclusion was reached after an examination of the skeletonized leaves and an examination of the stomach-contents of the larvæ. The larvæ also prefer the shadier places and are never found where the direct rays of the sun reach them. When a handful of the leaves is taken and the leaves separated, the exposed larvæ immediately seek shelter, traveling very quickly.

In order to know the habits of the larvæ better, several of them were placed in a glass jar and observations were made of

their activities in the water and on the leaves. They normally seek the underside of the leaves as much as possible and travel over them in a gliding manner. When jarred from the leaves or from any other object upon which they may be, they immediately rise to the surface of the water and crawl in an inverted position by means of their legs and elongate antennæ which serve as flagella. The last abdominal segment protrudes through the surface film and in this way they are able to breathe air directly by means of two spiracles situated on the last segment. There are also five fleshy protractile protuberances whose function the writer has not been able to determine. When hanging on the surface film, it is very difficult for the larvæ to descend to the bottom again unless there are leaves or other objects on which they can gain a foothold. This is due to the fact that they are supplied with very large tracheal tubes which, when filled with air, keep them afloat.

In the latter part of April and in the month of May many of the larvæ were found to be covered with an epiphytic, colonial protozoon, *Epistylus flavescens* Ehr. This thickly-clustered, tree-like organism gives the larvæ a whitish appearance, occurring on the dorsum of the larvæ and more usually towards the anterior end.

The rearing of the larvæ in the laboratory required very little attention except to provide them with sufficient water. On the fourteenth of May, many larvæ were found actively crawling around on the surface of the dry soil and excavating cells in the soil in which to pupate. On the fifteenth of May, one pupa was found. The pupal cell is spherical and a little larger than the pupa. The white pupæ may be easily recognized by the presence of four white, long, slender appendages on the prothorax. These very likely serve as spacers to keep the body from being covered with a body-film of water from the surrounding wet soil. They may also act as levers which enable the active pupæ to turn over, as they often do, especially when disturbed. On the twenty-third of May the first adult was found and from then on they were seen more often. An attempt was then made to find the pupæ in their natural environment. A considerable amount of soil was searched on the bank where the soil was drier, but no pupæ were to be found. A large log, partly submerged and covered with moss,

was then examined. This yielded satisfactory results. Five pupæ were found under the bark in cells which were made of chewed-up wood pulp. The cells were approximately three millimeters high and placed between the bark and the wood. Many larvæ were also found actively crawling through the soft, water-soaked wood. Unfortunately, there were no cells in the process of formation, so that the methods of construction could not be observed.

On the twenty-third of June, the last trip was taken to Ringwood Hollow to collect the adults. They were very scarce and only five were taken. The adults were found among leaves along the bank and in the shadier places, characteristic localities of the larvæ also. The adults are very active and, when disturbed, they attempt to hide under other leaves or they may take to flight. No adults could be found by beating the surrounding vegetation.

As to the complete life-history, there was insufficient time available to get the eggs. From the general habit of the larvæ and the adults, it is very likely that the adults lay their eggs under the leaves along the shore of the pools, in the late spring and early summer. They hibernate in the larval stage either in the second or third instar, depending upon whether there are four or five larval moults. There are two moults in the spring before pupation. Under natural conditions, the pupal stage lasts from ten to fourteen days, depending upon the temperature, while in the laboratory, the period was from seven to ten days.

#### DESCRIPTION OF THE STAGES OF PRIONOCYPHON LIMBATUS LEC.

*Larva.* Body subovate, widest at middle, broadly rounded in front and behind; lateral margins setose, 9-10 setæ on each abdominal segment, 8 on thoracic segments divided into 2 groups; color, dusky chestnut brown; length, 9-10 mm. Head-quadrate, transverse, inserted into thorax to the eyes, rounded on sides, punctate; eyes large and conspicuous; long seta dorsad of eye; epicranial suture extending from eye to vertex, irregularly sinuate; antennæ inserted before eyes, very long, 100-150 segments; labrum quadrate, recurved on sides, strongly setose along cephalic border; epipharynx attached to the ventral surface, very compli-

cated (Fig. 6); mandibles strongly curved with their tips meeting, one long subapical seta, anterior margin with ten setæ, inner surface strongly grooved, densely hairy and punctate; maxillæ elongate, cardo subtriangular with basal angles rounded, stipes irregular with small tuft of setæ on outer edge, palpifer subquadrate, lacinia and galea rounded, hairy, palpus five-jointed, second joint setose; labium quadrate, lateral margin with 12 setæ, palpus 2-jointed, inserted on lateral anterior margin; hypopharynx inserted on labrum, very complicated (Fig. 7); antennæ very elongate, filiform, 100-150 segments, basal joint largest and setose, second joint with few apical setæ, following segments small and similar with two sensory pits on each, length 7-9 mm.

*Thorax*.—Quadrate, wider than head, lateral margin with 8 setæ in two groups on each segment; meso and metathorax two-thirds as long as prothorax, dorsal surface broadly rounded, sparsely and finely punctate. Legs lighter brown than body; coxæ transverse, elongate, separate; trochanter small, divided, sparsely setose; femora and tibiæ subequal, setose in regular rows; tarsi toothed, unisetose.

*Abdomen*.—Densely and finely setose, sub-ovate, tapering to apex, ninth segment four-lobed, bearing two spiracles and five retractile protuberances.

*Tracheal System*.—The larvæ are also easily characterized by having a very large tracheal system composed of two large air reservoirs leading from the anal spiracles. These two large sacs meet in the thorax and do not appear to give rise to any tracheæ in the abdominal regions. In the prothorax are found two small sacs which are connected to the main sac and which give rise to the tracheæ leading into the head. From the prothoracic portion of this main sac, there also arise two tracheæ which divide into smaller branches which lead to the prothorax. Behind each of the legs there is an additional small air-sac which supplies the legs. The tracheal system was observed by placing the larvæ, just after they had moulted and were lightly chitinized, into a solution of hæmotoxylin. The larvæ were very active at first but soon became quieter, when their internal structures could be observed. They will live several hours in this stain.

*Circulatory System*. The heart is also easily seen, extending from the penultimate abdominal segment to the thorax and the dorsal aorta extends to the middle of the prothorax. The ostia

also show very plainly. When the larvæ are motionless in the solution of hæmotoxylin, one can readily see the blood flow from the aorta into the head and from there to other transparent parts of the body. The *Brain* is composed of two fairly small lobes situated posteriorly in the head. The optic and antennal nerves can be traced very well, especially the latter. The subœsophageal and ventral ganglia could not be seen.

*Pupa.* White, turning brown before emergence. Body rugose and hairy. Head inserted deep into thorax to the eyes; eyes finely granulate; antennæ inserted between and before the eyes, 11-segmented, one-half length of body; labrum prominent, subquadrate, setose; labial palpi 4-jointed. Thorax with 4 long white tubercles, anterior pair the longer; medial discal impression present; mesothorax small, quadrate; methathorax transverse, finely punctate. Abdomen 9-segmented, tapering, finely punctate and hairy, 9th segment bearing two lobes.

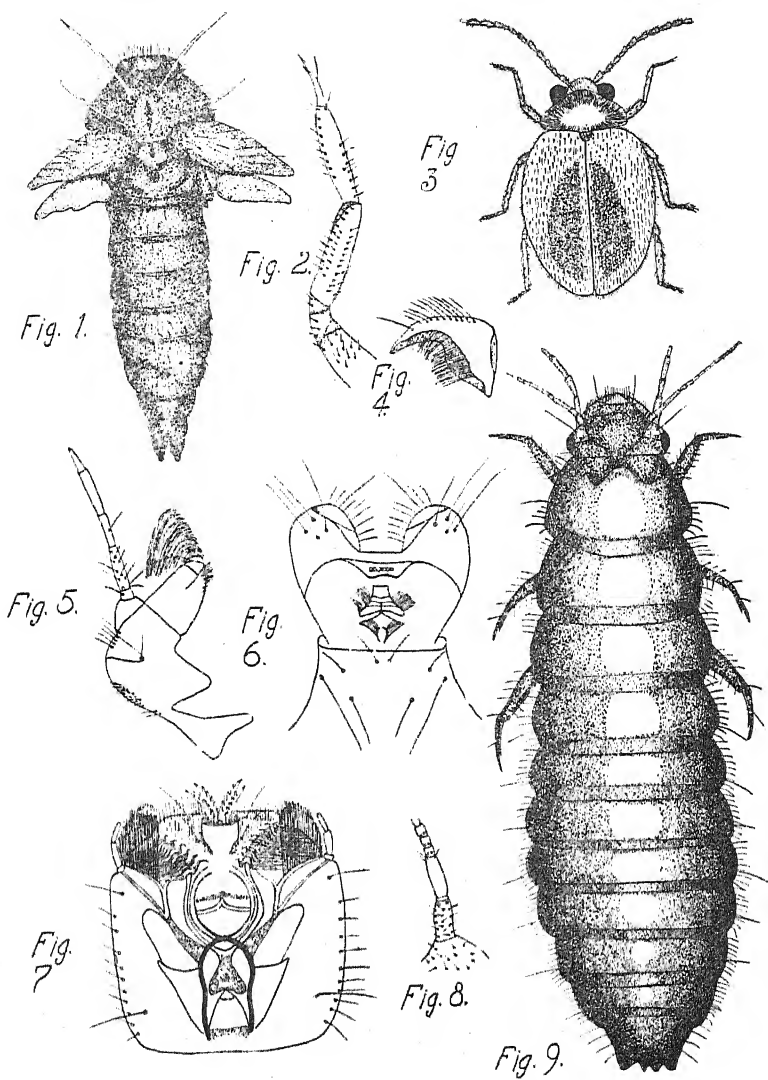
#### DESCRIPTION OF THE ADULT

Body ovate, moderately convex, yellow-brown, elytra with large median dark spot, variable in size; front between the eyes with rounded dark band. Head retracted into thorax to the eyes, deflected; antennæ eleven-jointed, yellow, segments 4-11 fus-cous; first segment subglobose, compressed, larger than the second and third united; labrum projected, transverse, prominent; terminal joint of maxillary palpus enlarged, triangular; labial palpi four-segmented, third arising from the side of the second; mandibles long, prominent. Thorax transverse, slightly narrowed in front, anterior margin sinuate; sides feebly rounded; surface finely and sparsely punctate, finely hairy; scutellum prominent, triangular. Prosternum prolonged between the front coxæ; coxæ separated, small, globose; trochanter distinct; femora wide, flattened; tibiæ slender, curved; metatarsus longer than the next two united; fourth joint deeply lobed, densely pubescent beneath, fifth joint small; middle coxæ contiguous, transverse, prominent; hind coxæ contiguous, large, grooved to receive the femora when in repose. Abdomen 5-segmented, equal in length, yellow, sparingly covered with fine hairs; elytra rather densely and finely punctate,

covered with silken hairs; epipleura wide at humeri extending to the apex. Length, 3.5-4.5 mm.

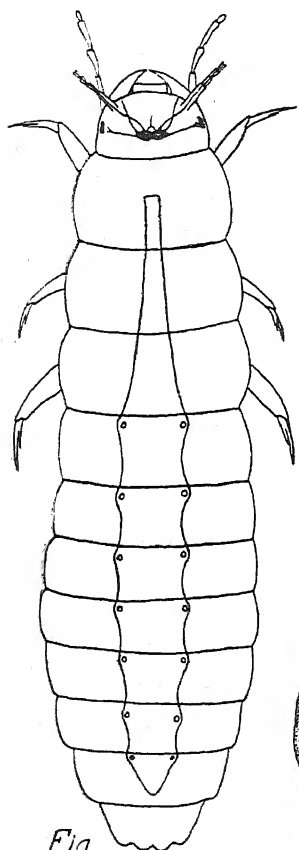
#### EXPLANATION OF PLATES VIII AND IX.

Fig. 1, Dorsal view of pupa.....	x17
Fig. 2, Left fore-leg .....	x65
Fig. 3, Adult, dorsal view.....	x17
Fig. 4, Right mandible .....	x65
Fig. 5, Left maxilla .....	x65
Fig. 6, Labrum and epipharynx .....	x135
Fig. 7, Labium and hypopharynx.....	x135
Fig. 8, Base of antenna .....	x65
Fig. 9, Larva, dorsal view.....	x25
Fig. 10, Heart and brain.	
Fig. 11, Pupa, ventral view .....	x17
Fig. 12. Respiratory system showing the trachea.	

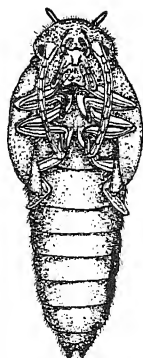


PRIONOCYPHON LIMBATUS

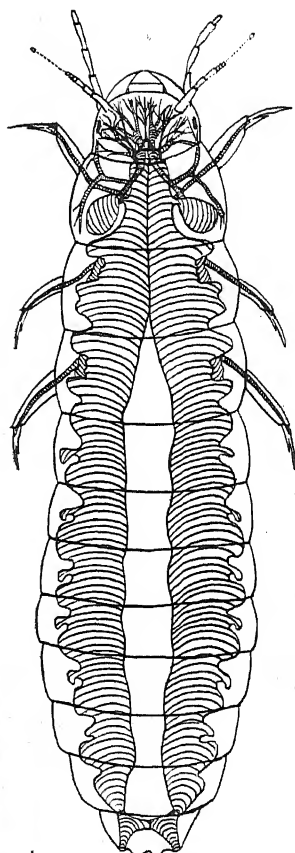




*Fig.*  
*10.*



*Fig. 11.*



*Fig. 12.*

PRIONOCYPHON LIMBATUS

## NEW SPECIES OF NORTH AMERICAN HYDROBIINI

By H. C. FALL,

TYNGSBORO, MASSACHUSETTS.

***Philhydrus elongatulus***, new species.

This name is proposed for a form occurring in Florida which is obviously close to *ochraceus* in all essential characters, and is possibly an extreme form of that species. The very small size and notably narrower body however give it a quite distinct appearance when compared in series with *ochraceus*. I have previously called attention to the fact\* that in *ochraceus* and *nebulosus* the very small emargination at the ventral apex is deeper and more obvious than in the other species in which it occurs; it may be significant therefore that in the present species this emargination is so extremely minute as to be detectable only with difficulty under the highest powers of the simple lens. Length 2.2 to 2.65 mm. (type 2.35x1.3 mm.).

The type is a female collected by the writer at Dunedin, Florida, Apr. 6, 1922. Other examples were taken at St. Petersburg and Tarpon Springs.

***Philhydrus blatchleyi***, new species.

Piceous black, sides of thorax more or less paler, elytral margins sometimes evidently paler, but often feebly or scarcely so. Form moderately elongate oval and only moderately convex, nearly as in *nebulosus*. Head piceous, sides of clypeus paler in both sexes. Punctuation a little closer and stronger than in *nebulosus*, the coarser punctures inconspicuous. Prosternum not carinate; mesosternal lamina with lower edge subhorizontal, anterior edge vertical, the free angle acutely produced. Ventral apex with minute emargination, which as usual is set with a close series of porrect spinules. Protarsal claws of male each with a moderately strong nearly rectangular basal tooth, that of the outer claw not appreciably larger; claws of middle and hind feet with similar but progressively smaller basal teeth, those of the hind feet sinuate within beyond the basal appendix in the male.

Length 3.5 to 4.3 mm.; width 2 to 2.4 mm.

The type is a male taken by the writer at Dunedin, Florida, and bears date IV-3-23. Other examples were taken at Tarpon Springs and St. Petersburg. It seems to be not uncommon and probably will be found in most collections of Florida material masquerading under some other name—perhaps *perplexus*.

In form and size this species resembles the larger examples of *nebulosus*, and in the case of somewhat immature examples

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\*Coleoptera of So. California—Occas. Pap. Cal. Acad. Sci. VIII., p. 217.

the similarity is very deceptive. By its sinuate posterior male claws it is to be associated (among eastern species) with *nebulosus*, *ochraceus*, *elongatulus*, *hamiltoni*, *diffusus* and *reflexipennis*. All these are normally of some shade of testaceous, while *blatchleyi* is truly piceous. Furthermore, *nebulosus* may be at once separated by its carinate prosternum, *ochraceus* and *elongatulus* by the feebly developed mesosternal lamina which is not mucronate, and the remaining three species by their more unequally and strongly toothed or lobed male claws, as well as the completely non-emarginate ventral apex. This distinct species is dedicated with a good deal of pleasure to friend Blatchley whose hospitality at his winter home at Dunedin, Florida, I have greatly enjoyed and with whom I have spent many pleasant hours in the field.

I take this opportunity to say that in the Californian *Philhydrus conjunctus* Fall, the hind tarsal claws of the male are really sinuate as in the above-named species, and not simply curved as I imply in the remarks following its description.

#### ***Cymbiodyta vindicata*, new species.**

Not long after the appearance of Horn's paper on the Hydrobiini (Phila., 1890), Mr. Frederick Blanchard (in litt.) called the Dr.'s attention to the fact that the series of *Cymbiodyta fimbriata* Melsh in his own and other collections was separable into two forms, one more rotundate and more convex, the other more elongate or oblong-oval and subdepressed. Blanchard was a very keen observer and a most careful student and rarely went wrong in matters of this sort, and although Horn would not acknowledge that there were two species involved, I am quite convinced that Blanchard was right. Investigation at Cambridge shows that the more broadly oval convex form is the one Melsheimer had in hand, and that Zimmermann's *semistriatus* is identical with this. For the narrower less convex form the above name is suggested. Aside from the difference in form, which is evident enough when the specimens are arranged in series, the true *fimbriatus* is vaguely but unmistakably substriate toward the elytral apex, while in *vindicatus* there is scarcely a trace of this striation. The two species are otherwise extremely similar.

Judging from my own collection *vindicatus* is a widely dispersed species. The type is a Tyngsboro, Mass., example bearing date 8-17-18. Other examples in my series are from Marion and Wakefield, Mass.; Farmington, N. H.; Rhode Island; Staten Island, N. Y.; Duluth, Minn.; Mile 17, H. B. Ry., Manitoba; Sumas, Wash.; Terrace, B. C. The true *fimbriata* on the other hand seems to be much more restricted in range.

My own examples are all from New Hampshire and Massachusetts, and in my experience it is in these States much less frequent than *vindicatus*.

***Cymbiodyta acuminata*, new species.**

Size, form and general aspect almost precisely as in the smaller specimens of *C. vindicata* or *Philhydrus perplexus*; color, lustre and punctuation substantially as in the species mentioned, but with the sides of the thorax as a rule more conspicuously paler, the pale margin also extending narrowly across the apex, and vaguely inward for a little distance along the base. The specific character however separating it from all our other species of the genus, is the elevation of the mesosternal transverse ridge at middle into a long subconical acute spur or mucro. This structure exists in the European *C. marginella*, to which our species is more closely allied than to any of our own fauna.

Specimens in my collection are from Edmonton, Alberta (F. S. Carr); Stonewall, Manitoba (J. B. Wallis), and Ritzville, Wash. (M. C. Lane). The type label is attached to an example from the first named locality and was taken "4-4-19" by Mr. Carr, from whom I first received the species.

In the Fauna Boreali Americana Kirby uses the name *Hydrobius marginellus* Fab. for "two specimens taken in latitude 54°." LeConte expressed the opinion that this was an erroneous identification, and suggested that the insect may have been *Philhydrus fimbriatus* Melsh. In the Leng List, Kirby's *marginellus* is referred to *C. lacustris* Lec. The correctness of this reference is very greatly doubt and would suggest as an alternative of greater likelihood that Kirby had in hand the present species, which inhabits that region and is really the North American analogue of *marginella* Fab.

***Cymbiodyta lacustris* Horn, (not Le Conte).**

While examining some types of our Hydrobiini on a recent visit to the Museum of Comparative Zoology at Cambridge I was not a little surprised to find that the unique Lake Superior type of *Philhydrus lacustris* Lec is really a *Philhydrus*, and not a *Cymbiodyta* as recorded in Horn's paper, and differs in no appreciable way from an ordinary dark colored specimen of *P. ochraceus* Melsh. The *lacustris* of LeConte thus becomes a synonym, and the *C. lacustris* of Horn's monograph, which is a true *Cymbiodyta*, must be written *C. lacustris* Horn.

***Anacaena signaticollis*, new species.**

This name is proposed for the form with variegated thorax which Horn conceived to be the *Brachypeplus infuscatus* of Motschulsky, and

which he describes in his paper on the *Hydrobiini* (Trans. Am. Ent. Soc., XVII, 1890, p. 275) as the normal condition in specimens "clean and free of discoloration." *H. feminalis* Lec., and *H. castaneus* Lec., are, according to Horn, also the same thing, the latter having been founded on "dark discolored specimens". There can be no doubt I think that *castaneus* Lec. is the same as *infuscatus* Mots, but in a good series of perfectly clean specimens there is never any sign of the thoracic markings which Horn figures (Plate IV, fig. 16). The thorax is invariably uniformly piceous throughout except as it becomes narrowly indefinitely paler at the side margins, agreeing thus with Motschulsky's description. *Feminalis* Lec., is not appreciably different. The form with the thoracic markings is, however quite distinct from the above. Not only is the coloration constantly different—always assuming of course that we have to do with clean specimens—but the form is somewhat more broadly oval and the convexity notably greater; the size also a little smaller. Moreover it is practically certain that the present form does not occur in Alaska (the type locality of *infuscatus*) nor even along the North Pacific Coast of the United States so far as I am aware. My series of *signaticollis* is from Southern California and New Mexico (Jemez Springs). I have attached the type label to a specimen from Pomona, California, bearing date "Mar. 25, '93."

***Paracymus longulus*, new species.**

Narrowly oblong oval, depressed; above piceous, head entirely so; thorax with rather sharply defined pale side margins, apical margin not evidently paler; elytra with side margins indefinitely paler. Surface lustre strongly shining, not visibly alutaceous, punctuation rather strong but not close, coarser and subseriate on the elytra. Body beneath piceous, opaque; legs entirely rufo—or brunneotestaceous.

Length 2.2 to 2.6 mm.; width 1.15 to 1.25 mm.

Described from three examples taken by the writer at Mitchell, Indiana, July 16, 1910.

This species is most nearly in accord with *B. monticola* Horn, agreeing with it in its 8-jointed antennæ, simple mesosternum and general habitus: it is however even narrower and more depressed, the thorax without pale apical margin, the elytra truly piceous, the legs entirely pale, the size somewhat smaller.

***Paracymus alticola*, new species.**

Oblong-oval, subdepressed, blackish piceous above, the elytra becoming indefinitely brownish apically, the side margins however not at all pallescent. Head entirely black. Prothorax with side margins rather

abruptly but very narrowly pale, the pale margin extending narrowly across the apex and somewhat more widely inward for a short distance along the base. Head and thorax finely alutaceous but shining, elytra with rather coarser punctures which are in great part subserially arranged, more especially toward the sides and apex. Femora piceous, tibiae and tarsi testaceous. Antennae 8-jointed, pro- and mesosternum entirely simple.

Length 2.75 to 3.1 mm.; width 1.55 to 1.75 mm.

Two examples, Tioga Pass, 10,000 ft., Sierra Nevada Mts. California 8-24-16; collected and kindly given me by Mr. J. O. Martin.

This species is even more nearly related to *monticola* than the last, differing but little except in its truly piceous elytra, these being always brownish testaceous in *monticola*.

#### **Paracymus seriellus**, new species.

Moderately elongate oval; outline, convexity and size very nearly as in *digestus*, from which it may be distinguished by the smooth and polished head and prothorax, without trace of alutaceous sculpture, and by the simple mesosternum. The punctuation is generally a little finer than in *digestus* but is somewhat variable. The elytral punctures are very distinctly serial or subserial in arrangement almost throughout, but most conspicuously so at sides where two of the series are more evidently impressed, simulating striae. In its simple mesosternum it agrees with *rufiventris*, but is much less convex than the latter and with the outer rows of punctures stronger and more evidently impressed.

Length 2.5 to 2.8 mm.; width 1.4 to 1.5 mm.

Described from five examples from California (San Bernardino Mts.; Pomona; Marin Co.). The type, collected by the writer, bears label "S. B. Mts. Cal. 7-16-'92".

This species naturally takes its place between *digestus* and *rufiventris* in Horn's table (Trans. Am. Ent. Soc. 1890, p. 270). It was identified for me originally as *rufiventris*, and probably so stands in other collections.

I am indebted to Mr. Liebeck for comparing a specimen of the present species and one of the true *rufiventris* with Horn's type, thus establishing the identity of the latter.

*Rufiventris* was described from Oregon. I have a single example from Washington and another from British Columbia but have not yet seen specimens from California.

## SOME NEW HALTICINI FROM INDIANA AND ONTARIO

By W. S. BLATCHLEY,

INDIANAPOLIS, INDIANA.

Since my paper entitled "Notes on Indiana Halticini, etc." was published in this JOURNAL<sup>1</sup>, a number of additional species have been taken in Southern Indiana, four of which are evidently new to science. Among some Coleoptera sent to me for naming by J. F. Brimley, of Wellington, Ontario, was also an undescribed species of *Longitarsus*. The descriptions of these new forms are as follows:

### *Disonycha admirabila*, new species.

Oblong, subparallel, convex. Thorax, under surface and femora dull yellow; antennæ in great part, scutellum and a sutural discal and submarginal stripe on each elytron, black; head and two narrow stripes on each elytron dull red, the red stripes bordered each side by a narrow one of silvery-white which lies adjacent to the black stripe; tibiæ and tarsi wholly fuscous-black; labrum and basal joint of antennæ piceous; last joint of antennæ pale. Head impunctate, the tubercles and frontal carina small, obtuse. Thorax two-thirds wider than long, absolutely smooth, sides rounded into base; front margin truncate, hind one convex. Elytra slightly wider at base than thorax, very finely alutaceous, minutely and very sparsely punctate. Abdomen and femora very finely punctate, minutely pubescent. Length 4.5 mm.

Knox Co., Ind., September 18. Taken by sweeping smartweed (*Polygonum*) in a dry upland woods. Allied to *caroliniana* (Fab.) but differs in its smaller more parallel form, dark labrum, wholly dark tibiæ and the alutaceous tricolored elytra. From *crenicollis* (Say) it differs in its smaller size, much narrower non-alutaceous and impunctate thorax without black spots and much more finely alutaceous elytra.

### *Longitarsus pallescens*, new species.

Broadly oval, convex, robust for the genus. Color above a uniform pale dull yellow; apical half of antennæ brown, labrum shining black; abdomen in great part chestnut-brown. Head impunctate, occiput finely alutaceous; antennæ very slender, joints 2-4 gradually slightly increasing in length. Thorax subquadrate, one-third wider than long, sides rather broadly rounded, front angles thickened, disk rugose, rather coarsely, shal-

<sup>1</sup>Vol. XIX, No. 1, March, 1921, pp. 16-27.

lowly irregularly punctate. Elytra oval, one-third wider at base than thorax, humeri rounded, umbones evident but small; disk finely, very shallowly evenly punctate. Under surface and femora very finely punctate, minutely pubescent. Length 2.8 mm.

Prince Edward County, Ontario, April 7. Two specimens collected by J. F. Brimley. Belongs under *c*, p. 18 of my key, *loc. cit.*, and allied to *subrufus* Lec., but differs in its pale color, much broader form, more slender antennæ, alutaceous occiput and rugosely punctate thorax.

***Longitarsus acutipennis*, new species.**

Elongate, convex; widest at middle of abdomen, strongly tapering behind, color a uniform shining pale brownish-yellow. Head impunctate, occiput minutely transversely strigose. Antennæ slender, three-fourths the length of body, joints 2-4 subequal in length. Thorax subelliptical, convex, one-half wider than long, sides rounded; disk minutely alutaceous, very finely and sparsely unevenly punctate. Elytra narrower at base than middle of thorax, thence gradually widened to middle, then tapering to the narrowly rounded or subacute tips; humeri, umbones and inner wings absent; pygidium concealed; disk rather coarsely, closely and evenly punctate. Length 1.8 mm.

Crawford County, Ind., August 5. Swept from goldenrod. Belongs under *ph*, p. 19 of my key, except that the pygidium is concealed. Of the twenty-one eastern species of *Longitarsus* at hand this differs from all in the strongly tapering posterior portion of the body. It is also paler than any of those belonging to the subgenus *Apterus* in which the humeri, umbones and inner wings are wanting.

***Glyptina ferruginea*, new species.**

Broadly oval, robust. Dark reddish-brown, shining, thorax and under surface somewhat paler than elytra; apical half of antennæ fuscous-brown. Head smooth. Antennæ slender, half the length of body, joints 2-4 subequal in length, 2 stouter than 3. Thorax subquadrate, convex, less than one-half wider than long, not narrowed in front, sides feebly curved, front angles slightly obliquely truncate; disk very finely, sparsely aciculate punctate. Elytra at base nearly one-half wider than thorax, conjointly oval, tips broadly rounded, striæ coarsely, somewhat rugosely and closely punctate, the ninth stria not more impressed than those on disk; intervals almost flat, each with a single row of very minute punctures. Length 1.3-1.5 mm.

Crawford Co., Indiana, August 1-4; three specimens taken by sweeping low herbage along a pathway on high wooded slopes. Allied to *brunnea* Horn but distinctly shorter and relatively broader, with antennæ darker and punctures of elytra coarser.



**Glyptina leptosoma**, new species.

Narrowly oval, strongly convex, tapering behind. Above and beneath reddish-brown, shining; antennæ reddish-brown, the apical third fuscous; legs pale brownish-yellow. Antennæ slender, two-thirds the length of body, second joint not stouter than third, slightly more than two-thirds the length of latter. Head impunctate. Thorax subquadrate, strongly convex, scarcely wider than long, side margins broadly curved, their front ends tuberculate; disk rather coarsely, shallowly, not densely punctate. Elytra conjointly oval, about one-fourth wider at base than thorax, sides broadly curved, strongly tapering behind the middle, to the narrowly rounded tips; disk strongly convex, punctures of striæ relatively coarse, those on sides finer; intervals flat, impunctate. Abdomen finely and sparsely punctate, minutely pubescent. Length 1.2 mm.

Crawford County, Ind., August 4; taken by sweeping goldenrod. Smaller, narrower and more strongly convex than either *brunnea* or *fer-ruginea*, the thoracic punctures coarser and the elytra much more narrowed behind the middle. In form it much resembles some of the smaller species of *Longitarsus*.

## THE INSECTS AND PLANTS OF A SALT MARSH ON THE COASTAL PLAIN OF NEW JERSEY

BY HARRY B. WEISS and ERDMAN WEST,

NEW BRUNSWICK, N. J.

### INTRODUCTION

This paper is the third of a series dealing with plant and insect surveys of various sections of New Jersey. The first dealt with conditions in a moist woods on the Piedmont Plain of New Jersey and the results were published in the *JOURNAL OF THE NEW YORK ENTOMOLOGICAL SOCIETY* (vol. xxx, No. 4, Dec., 1922, pp. 169-190). The second covering an area in the "pines" of New Jersey was submitted to "*Ecology*". The present paper is concerned with the plants and insects of a salt marsh on the coastal plain of New Jersey. In all three papers an effort was made to show the types of insect food habits present and their relationship to the flora.

### ACKNOWLEDGMENTS

The insects collected were identified by the following entomologists, to whom we are greatly indebted: Mr. C. W. Johnson, Diptera; Mr. C. A. Frost, nearly all of the Coleoptera; Mr. Howard Notman, Staphylinidæ; Mr. Henry L. Vierick, Hymenoptera; Mr. William T. Davis, Orthoptera and Odonata; Mr. Harry G. Barber, Hemiptera; Mr. C. E. Olsen, Cicadellidæ and Fulgoridæ; Mr. M. R. Smith, Formicidæ.

### THE NEW JERSEY SALT MARSH

About three-fifths of the entire area of New Jersey belong to the coastal plain and the salt marsh areas are found for the most part lying between the bars fringing the coast and the mainland. Marsh land is found also along Delaware Bay and extending for some distance along the rivers stretching inland through the marshes. Mr. C. C. Vermeule (Geol. Survey, N. J., vol. I, 1888, p. 178) has calculated that some 660 square miles of New Jersey including some small water areas consist of tide marsh,

this estimate including the tide marshes of the Hackensack valley. Excluding the Hackensack valley marshes, the tide marsh area of the coastal plain embraces about twelve per cent of its area.

Prof. John B. Smith (N. J. Agr. Exp. Sta. Bul. 207, pp. 6-8), writing about the New Jersey salt marsh and its improvement, states that there are three general types of marsh land. The first is covered at every mean high tide and may or may not support sedge or joint grass. This type is more plentiful south of Great Bay and is the smallest in area. The second type is rarely covered at ordinary tides but is so little above mean high water that slight rises due to wind, storm or moon changes result in a watery covering. This type may be covered by sedge but more usually has a thin growth of joint grass and is generally very flat and level. This type is also more plentiful south of Barnegat Bay. The third type is above mean high tide but likely to be covered by spring and fall tides and by winter or storm tides. Such marsh is more or less completely covered by vegetation and cut by creeks and waterways.

Dr. Witmer Stone (Plants of So. N. J., N. J. St. Mus. Rept., 1910, p. 97) lists some 40 species of plants as making up the true salt marsh vegetation and states that of these, *Spartina patens*, *Distichlis spicata*, *Juncus gerardi*, *Salicornia europæa*, *S. bigelovii* and *S. ambigua* make up the bulk of the vegetation on the open marsh. Prof. Smith (loc. cit.) states that the upper layer of the average salt meadow extending from 12 to 18 inches in a huge sponge composed of a mass of roots and vegetable material capable of holding water and drying out slowly by surface evaporation. A salt marsh sod 10 by 10 by 27 inches weighing 121 pounds was taken by Prof. Smith from the Raritan marsh in 1907 and turned over to Dr. Jacob Lipman, who furnished the following statement concerning it:

Original weight .....	121	pounds
Dry weight .....	23.39	pounds
Moisture .....	80.67	per cent
Dry matter .....	19.33	per cent
	Upper portion	Lower portion
	per cent	per cent
Nitrogen .....	0.65	0.63
Organic matter .....	34.23	21.30
Ash .....	65.75	78.70

Dr. Lipman also stated that "the spongy, fibrous character of the upper portion of the sod is gradually modified in its lower portion. The distinct root structure tends to disappear and with the darker color the entire mass becomes more compact and resembles muck rather than peat. The proportionate amount of carbon and ash are both increased, while the proportion of organic matter is diminished."

### THE SURVEYED AREA

The surveyed area consisted of about five acres of marsh belonging to the third type as outlined by Smith and having a shape somewhat similar to an isosceles triangle. The two long legs of the triangle were bounded by rather wide natural ditches and the base by a narrow, artificial ditch. The short and one long side of the triangle were protected from the waterfront of Raritan Bay by large bluffs but the other long side faced the balance of the Cheesequake meadow which extends inland along the Cheesequake creek. The exact location which lies in about latitude  $40^{\circ} 27' N.$  and longitude  $74^{\circ} 15' W.$  will be found on the accompanying map. Collecting was done at regular weekly or ten-day intervals throughout the seasons and an effort was made to obtain a fair sample of the species present regardless of the groups to which they belonged. The prevailing winds were toward the bluff and waterfront of Raritan Bay and for this reason it is supposed that not many species from the bluff found their way to the marsh. Most of the species were collected by sweeping the vegetation. Sifting of the soil was out of the question on account of its water-logged condition.

Dr. W. Rudolfs, bio-chemist at the New Jersey Agricultural Experiment Station, very kindly examined a sod taken from the section where the survey was made and supplied the following table, which shows the hydrogen-ion concentration at different depths as indicated by the values under pH. The hydrogen-ion concentration indicates the active acidity of the soil *in toto* and the lower the figure, the greater the acidity, the neutral point being 7.0.

	pH	Color of supernatant liquid
Soil three inches deep .....	6.6	transparent
Soil six inches deep .....	6.2	yellow xxx
Soil nine inches deep .....	6.4	yellow xx
Soil twelve inches deep .....	6.9	yellow x
Water in hole from which sod was taken.....	6.9	transparent

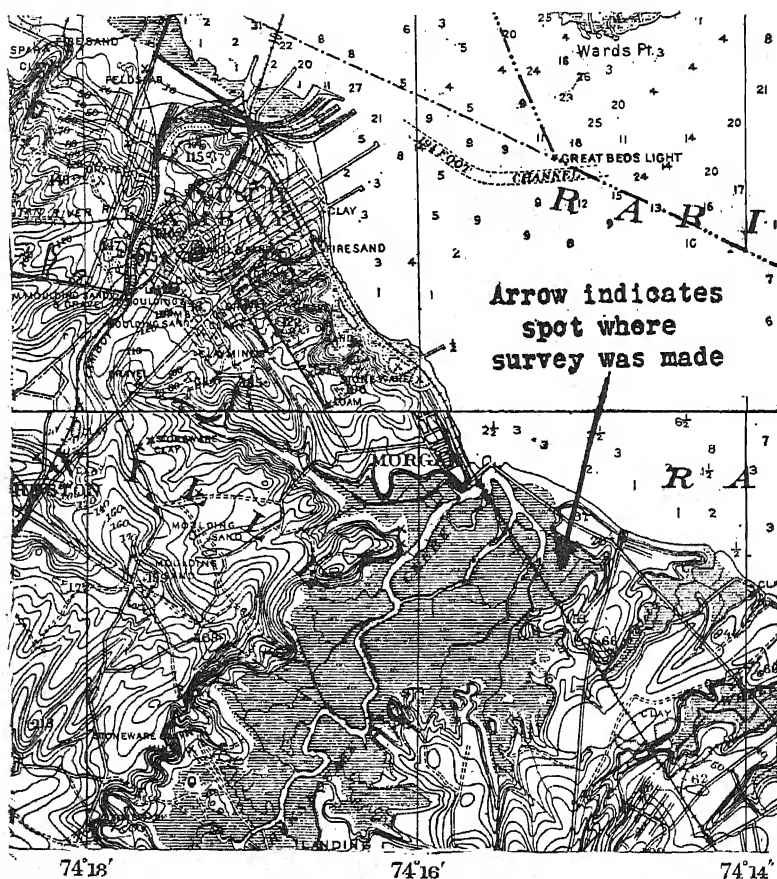


FIG. 1.—Map of Cheesapeake Marsh showing where the survey was made.

Dr. Rudolfs stated that the changes in reaction in the different layers of soil and the change in color seemed to indicate that the area was occasionally flooded by salt water, and this was true as observed during the survey. Some of the salt stays in the top layer and with progressive depths a part is leached out or possibly taken up by the plants, whereas at the place where the root systems of the plants stop, hydrogen-ion concentration decreases and goes up nearly to the neutral point. Dr. Rudolfs suggests that this might be caused by poor drainage at this depth, especially since the water in the hole registered the same degree of hydrogen-ion concentration. The yellowness of the water indicates that the roots are decaying leaving a colloidal substance in the soil.

#### THE VEGETATION OF THE SURVEYED AREA

The vegetation of salt marshes in general is characterized by the monotony of its general aspect, for it lacks contrasts or even striking variations in the color or size of its component parts. The vegetation of the surveyed area was no exception to the rule; in fact, the general trend was emphasized in the paucity of the species present and the marked tendency for them to grow in pure stand. Three typical salt marsh plants, *Spartina patens*, *Distichlis spicata* and *Juncus gerardi*, covered a large proportion of the marsh. The first two only showed a slight tendency to intermingle and at least sixty per cent of the area was covered by these two plants. The other forty per cent was composed of the various other species mentioned later with *Spartina glabra* and *Juncus gerardi* as the most prominent. As a whole the marsh was well drained and there was an absence of pools or "rotten spots" as they are frequently called. However, a few plants characteristic of such conditions were found mingled with the grasses mentioned above. *Atriplex patula*, *Salicornia europæa* and *S. mucronata* were three well distributed though inconspicuous species. They were most numerous where the grass mat was least dense. Occasional patches of sea lavender, *Limonium carolinianum* were conspicuous at blooming time with their large mist-like sprays of lavender colored flowers. Their broad leaves were also different from the usual leaf-type of the marsh.

Along the creeks and ditches there was a border of tall, salt grass, *Spartina glabra*. Where the banks were sloping and low, the border was wide, but where the banks were steep, it was narrow, and the dividing line between it and the low grasses of the marsh proper was sharp. Along the banks of the larger streams there was mingled with the tall salt grass the shrubby marsh elder *Iva oraria*, which sometimes extended along the smaller ditches where the tall, salt grass did not invade.

A vista of the entire area after the first of July showed a flat marsh dissected at irregular intervals by hedges of marsh elder or the tall, salt grass or both. In the flat marsh, especially where *Spartina patens* predominated, the low grassed were billowed and sometimes almost prostrate from the effects of the prevailing winds, together with the work of occasional high tides.

#### THE INSECTS OF THE SURVEYED AREA

The following tables summarize the insect findings by orders and families:

##### INSECTS COLLECTED ON IVA ORARIA

Order and family	Number of species	Order and family	Number of species
Neuroptera		Coleoptera	
Chrysopidae .....	1	Coccinellidae .....	5
Homoptera		Lampyridae .....	1
Aphididae .....	1	Cerambycidae .....	1
Cicadidae .....	1	Chrysomelidae .....	3
Membracidae .....	1	Curculionidae .....	1
Hemiptera			
Lygaeidae .....	2		18
Miridae .....	1		

The marsh elder which fringed one bank of the marsh was inhabited by plant lice and five species of coccinellids. The lampyrid *Chauliognathus marginatus* was also rather plentiful on this plant, as were numerous specimens of the lace-wing *Chrysopa oculata* Say and its long stalked eggs. During the sweeping of these plants in July and August several females of *Tibicen*

*chloromera* Walker were disturbed. In addition, many of the bushes were infested by nymphs and adults of the membracid *Micrutalis calva* Say and adults persisted from early June until the middle of September. The mirid *Lygus pratensis* L. was present, and several species of *Lygaeidae*. The curculionid *Baris interstitialis* Say was observed feeding on the stems and during June and July large numbers of the chrysomelids *Paria canella aterrима* Oliv., and *Systema pallicornis* Fab., appeared and fed extensively on the leaves and stems, causing them finally to turn brown and die. In addition, some of the stems which were cut open were found to contain cerambycid larvæ.

#### INSECTS TAKEN IN FLIGHT OR BY SWEEPING THE MARSH

Order and family	Number of species	Order and family	Number of species
Platyptera		Erotylidae .....	1
Sialidae .....	1	Histeridae .....	1
Odonata		Dasyllidae .....	1
Agrionidae .....	2	Lampyridae .....	1
Libellulidae .....	2	Malachidae .....	2
Homoptera		Cleridae .....	1
Fulgoridae .....	9	Bostrychidae .....	1
Cicadellidae .....	9	Scarabaeidae .....	1
Chermidae .....	2	Chrysomelidae .....	7
Hemiptera		Mordellidae .....	1
Pentatomidae .....	5	Curculionidae .....	7
Lygaeidae .....	6	Calandridae .....	2
Nabidae .....	1	Lepidoptera	
Reduviidae .....	1	Pyralidae .....	2
Anthocoridae .....	1	Microlepidoptera .....	2
Miridae .....	2	Hymenoptera	
Salidae .....	1	Braconidae .....	2
Orthoptera		Ichneumonidae .....	8
Acridiidae .....	3	Eulophidae .....	1
Locustidae .....	2	Pteromalidae .....	2
Coleoptera		Encyrtidae .....	1
Cincindellidae .....	1	Diapriidae .....	1
Carabidae .....	5	Ceraphronidae .....	1
Staphylinidae .....	2	Formicidae .....	5
Phalacridae .....	2	Tiphidae .....	1
Coccinellidae .....	1	Eumenidae .....	1



Order and family	Number of species	Order and family	Number of species
Ceropalidæ .....	1	Pipunculidæ .....	3
Sphecidæ .....	2	Syrphidæ .....	4
Crabronidæ .....	1	Tachinidæ .....	5
Larridæ .....	1	Sarcophagidæ .....	2
Halictidæ .....	2	Muscidæ .....	3
Dryinidæ .....	1	Anthomyidæ .....	5
Diptera		Scatophagidæ .....	1
Tipulidæ .....	3	Borboridæ .....	2
Chironomidæ .....	3	Sciomyzidæ .....	2
Culicidæ .....	2	Ortalidæ .....	2
Mycetophilidæ .....	1	Ephydridæ .....	7
Stratiomyidæ .....	2	Oscinidæ .....	7
Tabanidæ .....	7	Agromyzidæ .....	2
Dolichopodidæ .....	9		

Most of the above species were taken by sweeping the marsh vegetation, the exceptions mainly being the *Carabidæ*, most of which were taken on the ground and the pentatomids *Podops cinctipes* Say found among the flat, matted stems of *Juncus gerardi* and *Rhytidolomia saucia* Say in similar situations on *Spartina patens*. Four species of dragon flies were captured and of these, *Erythrodiplex berenice* D., appeared to be quite common. Of all the families listed, the *Cicadellidæ* was one of the best represented, some ten species having been captured, several of which were quite common. *Spartina patens*, *Distichilis spicata* and *Spartina glabra* seemed to be very attractive to fulgorids and cicadellids, some species occurring in countless numbers and whitening the foliage by their feeding. *Draculacephala mollipes* Say, *Hecalus lineatus* (Uhl.) and a species of *Thamnotettix* were rather plentiful. In the *Fulgoridæ*, *Aphelonema decorata* (Van D.), *Pissonotus aphidioides* Van D., *Oliarus humilis* (Say) were quite conspicuous.

In the Hemiptera, *Nabis ferus* L., *Trigonotylus ruficornis* Geoff., and *T. uhleri* Reut., were present in numbers. In the Coleoptera only a single specimen of the salt marsh tiger beetle, *Cicindela marginata* Fab., was taken. The staphylinid *Trogophilæus nanulus* Csy., was frequently captured and the only other species noted in numbers aside from those mentioned as feeding

on marsh elder, was *Hypera punctata* Fab., the clover leaf beetle. This curculionid was quite plentiful during the last of August and first part of September resting on erect stems of *Spartina patens* and on the upper portions of *Spartina glabra*. Mention should be made of the presence of *Sphenophorus setiger* Chit., and *S. venatus* Say which probably breed in reeds and grasses. In the Hymenoptera, the most plentiful species were *Chelonus sassacus* Vier. (*Braconidæ*), *Bassus* sp., *Hemiteles areator tenellus* Say (*Ichneumonidæ*), a species of *Eulophidæ* and a species of *Chloralictus*.

The best represented order was the Diptera with thirty-four per cent of the total number of species collected. Species present in large numbers were *Helobia hybrida* Meig., (*Tipulidæ*), *Aedes sollicitans* Wlk., (*Culicidæ*), *Nemotelus melanderi* Bks., (*Stratiomyidæ*), *Tabanus nigrovittatus* Macq., (*Tabanidæ*), *Sympycnus lineatus* Lw., *Dolichopus marginatus* Aldr., *Pelastoneurus lamellatus* Lw., (*Dolichopodidæ*), *Pipunculus scoparius* Cress., (*Pipunculidæ*), *Platychirus quadratus* Say, *Toxomerus marginatus* Say (*Syrphidæ*), *Myiophasia atra* D., (*Tachinidæ*), *Limnospila albifrons* Zett., *Lispa albitarsis* Stein., *Cænosiola lata* Wlk., (*Anthomyidæ*), *Leptocera limosa* Meig., (*Borboridæ*), *Chaetopsis ænea* Wd., *C. apicalis* Johns., (*Ortaliidæ*), *Botanobia dorsata* Aldr., and *B. trigramma* Lw. The last mentioned species was present by millions and sometimes filled our nets almost to the exclusion of other species.

#### SUMMARY

The foregoing tables and text show that the salt marsh supports a varied insect fauna. Prof. John B. Smith (Insects of New Jersey, N. J. St. Mus. Rept. 1909, p. 30) writing about the coastal strip of New Jersey including the marshlands lying between the bars fringing the coast and the mainland speaks of the insect fauna as being scant. Used relatively as was probably intended, this is true, but the salt marsh of New Jersey is far from being devoid of species. The next two tables deal with the species present by orders and with the types of food habits, the latter being based for the most part on the predominating larval habits of the

families and on the species present, regardless of numerical abundance. The disadvantage of using the family as a unit is appreciated and this matter and that of numerical abundance have been gone into in a former paper.

#### INSECTS OF THE MARSH.

Order	Number of species	Per cent of total
Platyptera .....	1	
Neuroptera .....	1	
Odonata .....	4	2
Homoptera .....	24	11
Hemiptera .....	20	10
Orthoptera .....	5	3
Coleoptera .....	48	23
Lepidoptera .....	4	2
Hymenoptera .....	31	15
Diptera .....	72	34
Totals .....	210	100

#### TYPES OF FOOD HABITS.

	Number of species	Per cent of total
Phytophagous .....	82	39
Saprophagous .....	44	21
Harpactophagous .....	55	26
Parasitic .....	26	13
Pollen feeders .....	2	1

As shown above, in point of number of species, the Diptera are the most important, followed in turn by the Coleoptera, Hymenoptera, Homoptera and Hemiptera. As shown by the last table, in a general way and regardless of numerical abundance, 39 per cent of the species present can be classed as phytophagous, 21 per cent as saprophagous, 26 per cent. as harpactophagous and 13 per cent as parasitic. The phytophagous percentage is made up largely by the *Fulgoridæ*, *Cicadellidæ*, *Lygæidæ* and several species of Coleoptera, Orthoptera and Lepidoptera. The saprophagous percentage consists for the most part of members of the

Diptera and their presence on a marsh containing a large amount of organic matter is not unusual. Predaceous species were supplied mostly by the Diptera and Coleoptera followed by the Hemiptera, Hymenoptera and Odonata. The Hymenoptera and Diptera supplied all of the parasitic species. It is believed that a fair sample of the species present on the marsh was obtained and that the types of food habits indicated above, as being associated with the marsh vegetation described, will be found in approximately the same ratios in other similar marsh areas.

#### EXPLANATION OF FIGURES

- Fig. 1, A view of a stream (at low tide) on one side of the surveyed area showing the growth of *Spartina glabra* along the edges.
- Fig. 2, A general view showing the wide stream on another side of the surveyed area.
- Fig. 3, A view of the surveyed area showing *Spartina glabra* in the foreground. *Spartina patens* occupies a large proportion of the balance of the area.

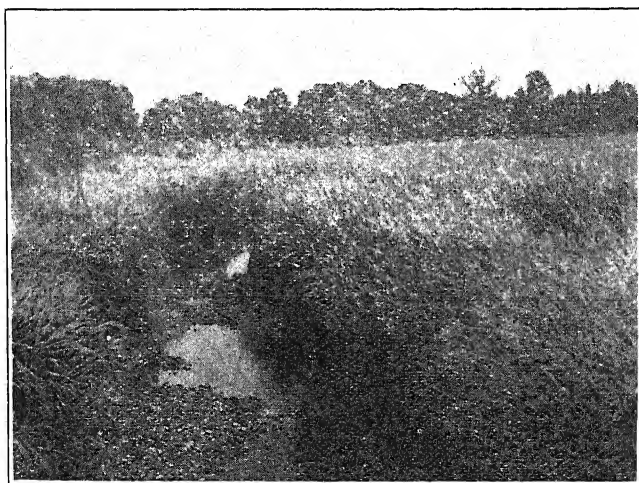


Figure 1

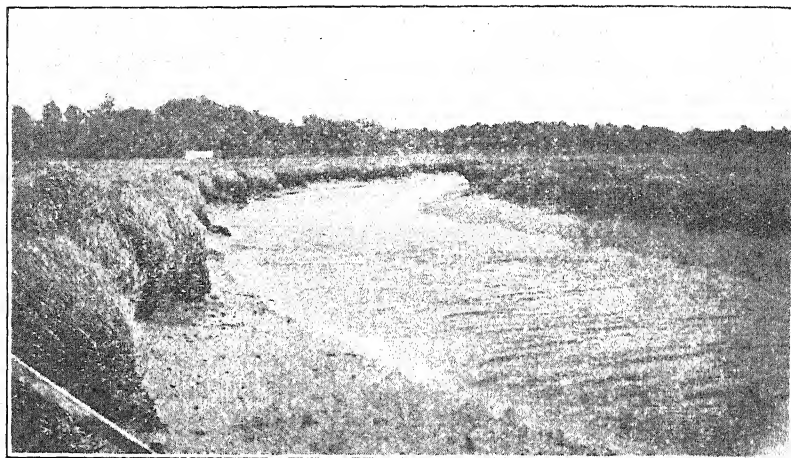


Figure 2



Figure 3

## A NORTHERN FORM OF THE BUTTERFLY NEONYMPHA AREOLATUS

BY WM. T. DAVIS.

STATEN ISLAND, N. Y.

In the "Catalogue of Diurnal Lepidoptera Described by Fabricius in the Collection of the British Museum" by Arthur G. Butler, London, 1869, two butterflies by the name of "*Papilio Phocion*" are mentioned. One was described in 1781 and the other in 1793. In Species Insectorum 2., p. 138, n. 642 (1781), Fabricius described a butterfly from Africa which Butler figures on his plate iii and credits to Sierra Leone. He further states on page 274: "Two wings of the type still remain in the Banksian Collection; *P. Phocion* is figured in Jones's unpublished 'Icones'. Fabricius described three Hesperidæ under this name."

In Entomologia Systematica iii, p. 218, n. 683 (1793), Fabricius described the second *Papilio phocion* from an unknown locality. Butler, however, on page 15 of the work already cited, gives "United States" as the locality. In his "Catalogue of the Diurnal Lepidoptera of the family Satyridæ in the collection of the British Museum," London, 1868, he also mentions the United States as locality for this butterfly. Samuel H. Scudder in "The Butterflies of the Eastern United States and Canada" (1889), likewise dates the American *phocion* from 1793, and not 1781, as has been done by most authors. In "The Butterflies of North America," 3rd series, 1897, Wm. H. Edwards, for instance, cites the 1781 description by Fabricius of the African butterfly, and then translates the 1793 description, the one supposed to cover our North American species. Edwards, however, considered that the description itself was "inapplicable", and used the name *areolatus* given the insect under consideration by Abbot and Smith in 1797.

It is also the opinion of the writer that *phocion* is inapplicable, not for the reason given by Edwards, but because in 1793, when Fabricius named his second *Papilio phocion*, he used a preoccupied name.

We still have to consider the name *Oreas fimbriata helicta* given to the insect under consideration by Jacob Hubner in Sammlung exotischer Schmetterlinge, 1806. There is no description, but his plate shows an insect with lines and spots about as in figure 3 on the plate accompanying this article; that is the two brown lines extending across the central portion of each hind wing approach each other and are almost connected. This seems to be a rather uncommon variation, of which the writer has but the single example here figured. In his Verzeichniss bekannter Schmettlinge, 1816, p. 65, he states under number 622 "*Neonympha Helicta*. *Areolatus* Abbot. Lepid. 13 Hubn. *Oread fimb. Helicta*."

Turning then to "The Natural History of the Rarer Lepidopterous Insects of Georgia", by Abbot and Smith, we find figured on plate 13 three specimens of *areolatus*; two figures of the upper side and one of the lower. This last shows four round blackish spots encircled by yellow on each fore wing, and six elongate spots encircled by yellowish on each hind wing. The spots on the hind wing are of the shape of those shown in figures 1 and 2 on the plate accompanying this article.

Boisduval and Le Conte in Lep. Am. Sept., 1833, plate 63. show the spots as elongate on the underside of the hind wings in *areolatus*. Samuel H. Scudder in "The Butterflies of the Eastern United States and Canada" (1889) shows on plate 14 a *phocion* from Georgia with five elongate spots on the underside of the hind wings. Wm. H. Edwards in "The Butterflies of North America", 3rd series, 1897, shows the underside of *areolatus* in figures 2, 4, and 5. Figure 2 shows long spots; 4 with slightly more rounded spots, and figure 5 a variation having a reddish colored line surrounding the spots. In Holland's "Butterfly Book", plate 25, figure 7, there is a colored figure of the underside of a *phocion* showing elongate spots.

Many years ago the writer observed that the numerous specimens of *Neonympha areolatus* Abbot and Smith, that he collected at Lakehurst, New Jersey, had the eye-like spots on the underside of the hind wings rounder than in specimens coming from Florida and the south in general. He at the time communicated this fact to Mr. Frank E. Watson, now of the American

Museum of Natural History, who kindly compared the specimens at hand and confirmed the observation as far as could be done at the time. Comparing at the present time 22 specimens from New Jersey, 6 from Raleigh, North Carolina, 1 from Southern Pines, N. C., 3 from Charleston, South Carolina, 17 from Florida and 1 from Harris Co., Texas, the observation made as stated above is again confirmed, and it is also found that the yellow encircling the blue of the eye-like spots is lighter in color in the southern specimens than in those from New Jersey. Further in Entomological News, Vol. XIV, p. 297, Nov., 1903, Mr. Philip Laurent in "Notes on the Butterflies of Miami, Florida", makes the following statement: "*Neonympha phocion* differs from our northern examples, in the fact that the anterior wings are not as much produced, besides there are other characters which at once will enable the student to separate the southern specimens from the northern." According to our observation, northern specimens have the outer margin of the fore wing somewhat more rounded or curved than in those from the south. Perhaps this is equivalent to stating that the latter is more produced.

The northern specimens appear therefore to be separable as a variety or race from the southern ones, and the name *septentrionalis* is here proposed for it. Type specimen from Lakehurst, N. J. (July), figured as number 4 on the accompanying plate.

The writer does not mean to imply that specimens of *areolatus* from New Jersey and vicinity may not occasionally show spots resembling those from Florida and Georgia. He simply wishes to point out that there is a rather constant difference between those from the north and south.

#### EXPLANATION OF PLATE X.

Fig. 1, *Neonympha areolatus*, Abbot and Smith, Lakeland, Fla., May 8, 1912.

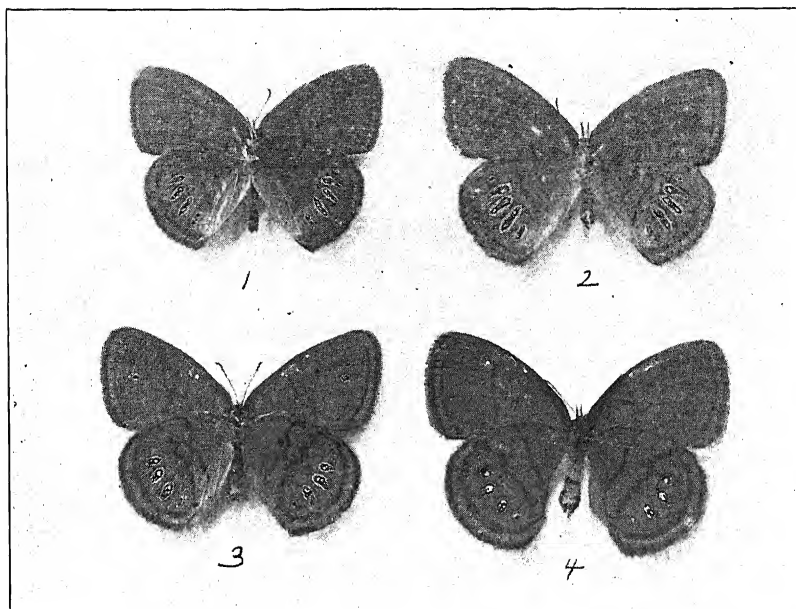
Fig. 2, *Neonympha areolatus*, Lakeland, Fla., April 13, 1912.

Fig. 3, *Neonympha areolatus* (*helicta* Hubner), Southern Pines, N. C., June 13, 1920.

Fig. 4, *Neonympha areolatus*, var. *septentrionalis*, Lakehurst, N. J. July. Type.







NEONYMPHA AREOLATUS



NOTES ON POLYGONIA J-ALBUM, CERCYONIS  
ALOPE, PHYCIODES THAROS, HEODES  
EPIXANTHE AND EUPHYDRYAS  
GILLETTI.

BY GAYLORD C. HALL.

*Aglais j-album watsoni*, new subspecies.

MALE: Differs from *j-album* Bdv., and Lec., in that the ground color is a richer fulvous and the dark markings larger. This gives the insect a darker appearance than the eastern form. Under side; the whitish outer band is strongly marked at the central line of demarkation between basal and outer halves of wings, and the band fades away rather abruptly and does not reach so far towards the outer margin as it does in the original type. The whole under surface is more variegated than the type, giving an affect of greater contrast between light and dark portions.

FEMALE: Upper and upper surfaces darker than the original type, the differences not being so great as in the male.

*Polygonia j-album* was described by Boisduval and LeConte who gave New York, Philadelphia and New Harmony, Indiana, as the localities where it was to be found. It is closely related to the European *l-album* Esp. and specimens from Eastern Mongolia resemble it very much. The American specimens, however, both eastern and western, are considerably larger and there are also minor differences.

This subspecies is named after Mr. Frank E. Watson of the American Museum of Natural History in recognition of many years of aid in the entomological field.

Type, male, Fig. 1, under surface. Taken at Sicamous, British Columbia on July 28, 1921 by G. C. Hall.

Allotype, female, same date and locality as type.

Type and allotype in the American Museum of Natural History. Paratypes 1, 2, 3, 4 and 5, males and 6 and 7, females in the collection of G. C. Hall.

*Cercyonis alope ino*, new subspecies.

MALE: Upper surface of wings dark. The two usual eye spots on the fore wing black, rather small, and containing small white pupils. Hind wing uniformly dark with the exception of inconspicuous marginal lines.

Under surface of fore wing; the two usual eye-spots conspicuous with fulvous outer rings and white centers. Under surface of hind wing; rather uniform in color, but area between marginal lines and center one, slightly lighter in shade and containing two minute eye-spots at and near the anal angle.

FEMALE: Upper surface lighter shade, the two eye-spots larger, with indication of yellow outer ring. Under surface fore wing; the two eye-spots ringed with yellow and containing large bluish pupils. Basal half of wing darker than outer half. Hind wing almost uniform in color, the basal half being somewhat darker. Two small eye-spots at and near the anal angle.

This form differs from *nephele* by the more uniform markings of the under surface, especially that of the hind wings, which in *ino* is to a large degree concolorous. Certain specimens present a hind wing without the slightest indication of the six spots and practically without any markings. In all cases the transverse striations are quite inconspicuous.

W. H. Edwards described *olympus* as the form found from Illinois to the eastern slopes of the Rocky Mts. *Ino* differs from *olympus* as markedly as it does from *nephele* which is found along the southern boundary of Canada to the eastern seaboard.

Type, male, Fig. 2, under surface. Taken at Calgary, Alberta, Aug., 1921.

Allotype, female, Fig. 3, under surface. Taken at Calgary on the same date.

Paratypes 1, 2, and 3, males and 4 and 5, females from Calgary. Paratypes 6, 7, and 8, males and 9 and 10, females taken at Starblanket, Saskatchewan by H. Hutchinson. All in the collection of G. C. Hall.

Type and allotype in the American Museum of Natural History.

**Phyciodes tharos pascoensis**, Wright, form vern. *herse*, new.

*Pascoensis* was figured by Wright in his Butterflies of the West Coast and is the western representative of *tharos*. *Herse* is the Spring form of *Pascoensis* and corresponds to the eastern *marcia* Edw., differing from the summer forms by the darker markings, especially those on the under surface of the hind wing.

Type, female, taken at Taft, British Columbia on July 29, 1921 by G. C. Hall. Type in the American Museum of Natural History.

Paratypes 1, 2, 3, and 4, females, same date and locality, in the collection of G. C. Hall.

**Phyciodes tharos pascoensis**, Wright, f. ab. *nigrescens*, new.

The fulvous ground color on upper surface of wings nearly obscured by black. Fore wing possesses an antimarginal row of fulvous spots and several near base. Hind wing has antimarginal row of fulvous blotches, most of which contain small black spots. Several basal spots are also present.

Type, female, taken at Taft, B. C., on July 29, 1921 by G. C. Hall. Type in American Museum of Natural History.

**Heodes epixanthe phædrus**, new subspecies.

MALE: Upper surface of wings much like *epixanthe*. Under surface lighter color, especially that of the hind wing which is a pearl gray, differing from that of *epixanthe* in which the color has an ochreous tinge. The spots on the hind wing are smaller and the marginal orange band near the anal angle is much reduced in size.

*Epixanthe* was described by Boisduval and LeConte from two specimens taken in New Harmony, Indiana. The specimens from central New Jersey and Massachusetts compare with their description.

Type, male, from Dublin Shore, Lunenburg Co., N. S. It is in the American Museum of Natural History.

Paratype, male, same locality. In the collection of G. C. Hall.

Paratype No. 2 from Crabbes, South-western Newfoundland. Taken by G. C. Hall and in his collection.

**Euphydryas gilletti** Barnes.

I believe this fine *Euphydryas* has never before been figured and I take this opportunity to show the upper surfaces of the male and female (Figs. 4 and 5). The specimens were taken the latter part of June, 1923, near Pinedale, Wyoming, and were found plentifully in the irrigated grass meadows at an elevation of 7,500 feet. Evidently the dates of emergence are from about the middle of June to the first part of July.

## EXPLANATION OF PLATE XII.

Fig. 1, *Aglais j-album watsoni*, ventral surface, male.

Fig. 2, *Cercyonis alope ino*, ventral surface, male.

Fig. 3, *Cercyonis alope ino*, ventral surface, female.

Fig. 4, *Euphydryas gilletti*, dorsal surface, male.

Fig. 5, *Euphydryas gilletti*, dorsal surface, female.



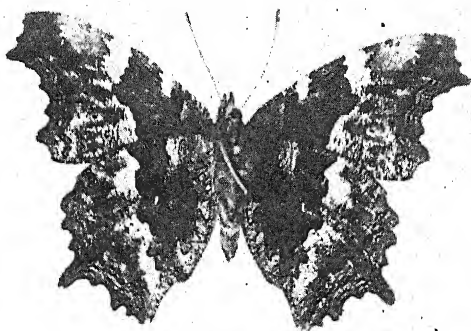


Fig. 1

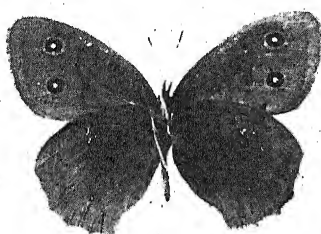


Fig. 2

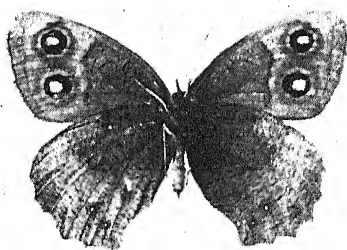


Fig. 3

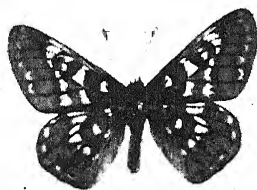


Fig. 4



Fig. 5





## MISCELLANEOUS NOTES

**Cicada-Killing Wasps and Flies:** Lately Mr. A. E. Brower of Willard, Missouri, sent me a male *Cicada hieroglyphica* and a *Polistes pallipes* wasp with the following memorandum: "Heard the Cicada feebly crying and found it upon the ground with the enclosed wasp feeding upon it, July 4, 1923." The head and a part of the pronotum of the cicada are gone, evidently eaten by the wasp. *Polistes pallipes*, in my experience, usually confines itself, when on killing bent, to caterpillars and other soft bodied larvæ. In the present instance the wasp may not have overpowered the Cicada, but finding it disabled, began feeding upon it.

At Arrochar, Staten Island, on September 10, 1916, Prof. Wm. S. Wright, called my attention to a male *Tibicen chloromera* (*sayi*), lying on the ground and being devoured by the large naturalized wasp *Vespa crabro*. The cicada was still alive and struggling though all of its legs had been eaten off.

At Lakehurst, New Jersey, July 9th, 1911, the robber-fly *Proctocanthus nigricentris*, was observed in the act of seizing a *Cicada hieroglyphica* on the low limb of a tree about fifteen feet from the ground. The insects were secured by climbing the tree. At Key West, Florida, September 16, 1913, the robber-fly *Erax interruptus* was observed killing a *Tibicen olympus*. The specimens mentioned are in the writer's collection and the robber-flies are more nearly the size of the cicadas they captured than is *Polistes pallipes* the size of *Cicada hieroglyphica*.

In Entomological News, July, 1923, p. 212, A. B. Champlain and J. N. Knull in "Notes on Pennsylvania Diptera" state regarding the robber-fly *Dasyllis grossa*: "An adult of this large fly was observed capturing a specimen of *Tibicen sayi* S. & G. in midair, at Montebello, Pa. The cicada was probably twenty feet from the ground when it suddenly dropped to earth with the *Dasyllis*. In this case the prey was too bulky to carry off, as is the usual practice."

WM. T. DAVIS.

**The Grape Leaf-hopper Infesting Sycamore:** On September 5, 1919, at Riverton, N. J., last stage nymphs and adults of *Typhlocyba comes* Say, the grape leaf-hopper were observed on sycamore trees. The nymphs were feeding on the leaves and numerous cast skins indicated that they had occurred in numbers previous to the date of observation. Dr. E. D. Ball who identified the species stated that it was the type form and that during the season of 1919, it was abundant on sycamore at Ames, Iowa.

HARRY B. WEISS.

**Errata:** In the June, 1924, issue (vol. xxxii, No. 1) on page 76, line 38, for "1916" read 1906.

## PROCEEDINGS OF THE NEW YORK ENTOMOLOGICAL SOCIETY

MEETING OF MAY 15, 1923.

A regular meeting of the New York Entomological Society was held in the American Museum of Natural History at 8 P.M. on May 15, 1923. President Harry B. Weiss in the chair, and 17 members and six visitors, present.

Mr. Davis exhibited seven cards from Mr. Notman by which his westward journey as far as Marquette was traced.

Dr. Lutz spoke of aquatic spiders from England now living in an aquarium, of special interest because none such occurs in the United States.

Dr. Lutz delivered an address, illustrated by stereopticon views, on "Some Work on the Biological Relations between Flowers and Insects" reading in part from his discussions of "Flowers and Their Insect Visitors" in "Natural History" XXIII, 1923.

Mr. Leng exhibited some portraits of entomologists illustrated in part by lantern slides loaned by Mr. Weiss which formerly were owned by Prof. John B. Smith, in part by slides in possession of Staten Island Institute of Arts and Sciences.

Mr. Davis showed portraits of Schwarz, Barber, Caudell and Heide-mann.

MEETING OF OCTOBER 2, 1923.

A regular meeting of the New York Entomological Society was held at the American Museum of Natural History at 8 P.M. on October 2, 1923. President Harry B. Weiss in the chair with 19 members present.

Newspaper accounts of Mr. Notman's travels and collections were shown and 47 postal cards which he had sent to Mr. Davis from different points on his travels.

Mr. Harry B. Weiss was, on motion by Mr. Davis, delegated to attend the Joseph Leidy Commemorative Meeting.

Dr. Leonard spoke of the collecting done during the summer in the Adirondacks, especially on Mt. McIntyre during the last week in June, in which Messrs. Bishop and Crosby took part. Mr. Young also had collected many small species. At the summit of Mr. McIntyre the Diptera were very numerous in the sunshine; at Mrs. Wood's house near No. Elba, Mr. Watson's visits were remembered and a *Papilio* near race *canadensis* was found; at Artists' Brook near Chapel Pond, sphagnum, Labrador Tea, and fungus gnats were found while solid ice was still unmelted among the boulders.

Mr. Nicolay recalled his visit to the same region with Messrs. Notman and Quirsfeld last year when *Nomarcus bilobus* was found; and described his visits to Washington, D. C., with Messrs. Shoemaker, Quirsfeld and Mason, to Greenwood Lake and to the beach of New Jersey.

Mr. Angell spoke of a visit to Montauk where Bumble bees were found whining around the brush near the beach and two specimens of *Rhizophorus* were taken near by. He also showed *Cicindela generosa* and the green form of *tranquarbarica*.

Mr. Wm. T. Davis stated that in company with Mr. Vosburgh and Mr. Leng he had spent some time during the summer in copying the grave-stone inscriptions in old St. Andrew's Church yard, Richmond, Staten Island. While so engaged he had observed a number of interesting insects. Numerous *Celtis* trees border the cemetery and attracted by them an occasional *Chlorippus clyton* butterflies. *Chlorion ichneumonca* had several burrows, and brought numerous nymphs of *Neoconocephalus* wherewith to store the underground chambers. They collected there long-horned grasshoppers in the low meadows that adjoin the cemetery. From one chamber, about the size of a hickory nut, seven *Neoconocephalus* nymphs had been taken. On August 31 the Rove-beetle identified by Mr. Notman as a species of *Gyrohypnus* was observed in numbers running about in circles on top of several grave stones. They were evidently pairing. On September 28, they were again present on the grave stones, but in less numbers. Mr. Davis further stated that the butterfly *Basilarchia astyanax* var. *albofasciata* had been seen by him and Mr. Leng at St. George, Staten Island on August 13, and the next day, either the same specimen or one much like it, had been brought to the Public Museum by two little girls who had captured it at St. George. Another *albofasciata* was seen by Mr. Davis and Mr. Ernest Shoemaker on the road south of Arlington, Staten Island on August 25. Several other specimens of this usually rare form, that had been taken previously on Staten Island, were also shown. Mr. Davis further exhibited a living male Mantid, *Paratenodera sinensis*, and stated that the species had now become fairly well established in several localities on Staten Island.

Dr. Lutz referred briefly to a trip he had made with Mr. Schwarz to the Everglades and to the continuance of his studies of the reactions of insects to color and especially to the ultra violet rays.

Mr. Bell spoke briefly of his visit to Yellowstone National Park and exhibited the Cicada *Okanagana bella* obtained there for Mr. Davis.

Mr. Watson had been occupied with local collecting for the museum, in which connection he gave his experience in collecting *Chlorippe clyton* and *Basilarchia albofasciata*; the latter he had never seen flying but slight transitions toward *albofasciata* were fairly common.

Mr. Hall said that near High Point in Sussex Co., N. J., he had once taken four in a day and altogether found eight. His principal summer trip had been to the mountains of Wyoming.

Mr. Barber had as usual spent some time in Virginia and had visited Lakehurst early in the spring where he had found much of the woodland burned. His studies in wild bed bugs indicated possibly two new species. He spoke also of the fine work by Dr. Knight on *Miridae* in Bull. 34 "Hemiptera of Connecticut".

Mr. Weiss had noticed an unusual abundance of lace bugs in which he was corroborated by Dr. Leonard. His particular task during the summer had been the study of two or three acres of salt marsh near Morgan where, in spite of a daily covering by the tides, diptera, coleoptera, etc., were abundant. He had also visited Lahaway once.

Mr. Dickerson in company with Mr. Bischoff had spent much time at Murray Hill and Berkeley collecting *Membracidae* and *Cicadellidae*.

Mr. Sherman reported on eight weeks spent at Randolph, New Hampshire with numerous trips to the summit of Mt. Washington, Mt. Jefferson and Mt. Adams. *Carabus chamissonis* was found on all these summits and in spite of the dry season butterflies were abundant. He mentioned several entomologists also whom he had met during the summer—Henshaw, Wheeler, Banks, and told of the sale of the Reynolds collection and library to Frank J. Souther, Chicago. Mr. Davis spoke of a letter from R. P. Dow which he would read at the meeting of the Brooklyn Entomological Society. Mr. Weiss told of the remembrances of him he encountered at Lahaway and Mr. Comstock spoke also of his repute among genealogists.

Dr. Leale closed the meeting with some recollections of Agassiz, whose pupil he had been, of Joseph Henry, and other famous people; and complimented his fellow members on their summer's work.

**STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC.,  
REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912,**

Of The Journal of the New York Entomological Society, published quarterly at New York, N. Y., for April 1, 1924.

State of New Jersey, }  
County of Mercer, } ss.:

Before me, a Notary Public, in and for the State and county aforesaid, personally appeared Harry B. Weiss, who, having been duly sworn according to law, deposes and says that he is the editor of the Journal of New York Entomological Society and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 443, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor and business managers are:

Publisher—New York Entomological Society, American Museum Natural History, New York, N. Y.

Editor—Harry B. Weiss, 19 North 7th Avenue, New Brunswick, N. J.

Managing Editor—None.

Business Managers—None.

2. That the owner is: (If the publication is owned by an individual his name and address, or if owned by more than one individual the name and address of each, should be given below; if the publication is owned by a corporation the name of the corporation and the names and addresses of the stockholders owning or holding one per cent. or more of the total amount of stock should be given.)  
New York Entomological Society, American Museum Natural History, New York, N. Y.

President, Harry B. Weiss, 19 North 7th Avenue, New Brunswick, N. J.

Secretary, Charles W. Leng, Staten Island Museum, St. George, S. I., N. Y.

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3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent. or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.) None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds or other securities than as so stated by him.

5. That the average number of copies of each issue of this publication sold or distributed, through the mails or otherwise to paid subscribers during the six months preceding the date shown above is.....  
(This information is required from daily publications only.)

HARRY B. WEISS, Editor.

Sworn to and subscribed before me this 16th day of April, 1924.

AUGUSTA JOHNSON.  
My commission expires Dec. 28, 1927.

# JOURNAL

OF THE

## New York Entomological Society

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### THE AMARANTH CURCULIO, CONOTRACHELUS SENICULUS LEC.

BY F. H. CHITTENDEN.

Some years ago, during the first week of September, the writer noticed that a variety of cultivated amaranth (*Amaranthus* sp.), growing at Washington, D. C., was dying, many large and otherwise beautiful plants being prostrate. Some, though rooted to the ground, had fallen over. Examination of the main roots disclosed large numbers of larvæ of what proved on rearing to be *Conotrachelus seniculus* Lec., working about the base. When the earth about the roots was examined later, larvæ were found to have issued from them and pupæ had also formed. Infestation through the entire planting was practically complete, 90 per cent. at a low estimate. Some plants showed a form of root rot which might have attacked the plants after the insects had been at work. By the third week of September, larvæ had become comparatively scarce and many pupæ were in the ground about the roots, and by the end of the month most of the adults had developed, numerous holes showing where they had emerged from the ground.

The first adult was reared September 28, but it was not completely hardened or mature until October 7. Beetles continued to mature until the end of October.

The larval habits of this species were recorded by the writer in 1898<sup>1</sup>. During August, 1897, numerous larvæ and pupæ were found about the roots and in the earth around the stems of rough pigweed (*Amaranthus retroflexus*). Unfortunately, the species was mentioned in that record as *C. elegans* Say.

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<sup>1</sup>Bul. 18, n. s., Div. Ent., U. S. D. A., pp. 95, 96.



In two localities in Maryland that were visited, a large proportion of the wild *Amaranthus* examined was infested. Larvæ were most numerous on mature plants within an inch or two of the surface, and the stems were considerably eroded where larvæ were at work. A dozen or so individuals usually comprise a colony about each wild plant, but ornamental amaranths harbor many more.

The first larva transformed to a pupa August 11, and the first imago appeared on August 18, having passed six and a half days in the pupal condition. Larvæ and pupæ, as would naturally be inferred, very closely resemble those of *Conotrachelus nenuphar* Herbst., or the plum curculio. A cell is formed for the pupa, but is of such rude construction that it is scarcely noticeable. The beetles have been collected about Washington late in May and early in June and are not so frequently seen in September and October, although abundant at the later date. Dr. W. D. Pierce, who identified the species, says that he has found the larvæ in amaranth roots in Texas, but did not succeed in rearing the adult.

The close resemblance of this species to *elegans* Say., has undoubtedly caused the two to be somewhat generally confused in collections. The following distinctions have been pointed out to the writer by Dr. Pierce:

Upper surface with short, erect setæ; prothorax distinctly carinate from apex to base.

Posterior femora with a large acute tooth and a small denticle  
*seniculus* Lec.

Upper surface without erect setæ; prothorax with feeble carina.

Posterior femora with two small denticles.....*elegans* Say.

Of the latter species, which has been called the "pig-nut leaf-weevil", Packard has written:<sup>1</sup> "We have observed this weevil at Providence (R. I.) busily engaged the last of May laying its eggs in the partly rolled up leaves of the pig-hickory (*Carya glabra*), and, during the process, cutting off the leaves, which hang down, wither, and turn black."

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<sup>1</sup>Packard, A. S.—Fifth Rept., U. S. Entom. Comm., p. 316, 1890.

The difference in the larval food habits of the two species will be noted, the one being a root- and stem-feeder, the other, according to Hamilton<sup>2</sup>, a leaf-roller.

### MIGRATION OF PYRAMEIS CARDUI

The 1924 annual migration of *Pyrameis cardui* in this region is beyond doubt the largest on record. The butterflies began to struggle across the border from Baja, California, about February 27, and soon became very abundant for seventy miles or more, or from coast to Colorado River. Today, March 15, the migration is about completed in Los Angeles County, the mass having crossed successfully the mountain range varying from 3,000 to 8,000 feet and getting into the Mohave and Ventura valleys. Most of the specimens were much worn but occasionally one was seen evidently freshly emerged. Their path was on the whole from the southeast, probably their direction following the low lands as far as possible. Food was abundant, the apricot and orange trees averaging from 25 to 100 specimens at any hour of the day. In the air they were not as numerous as one sometimes sees *A. plexippus* in its similar migration in the east. They were, however, constant. At any given point in open space one could count from 50 to 300 a minute and the speed of flight averaged not far from 15 miles an hour. Moreover, these numbers hold good for at least 1,000 square miles and they were not less numerous at the 5,000 feet levels than in the low lands; besides, there was no diminution of numbers between sunrise and sunset. One can easily imagine that the total number of them living at one time in three counties is larger than the human population of the entire world.

R. P. DOW, *Sierra Madre, California.*

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<sup>2</sup>Hamilton, J. A.—Trans. Am. Ent. Soc., vol. XXII, 1895, p. 376.

NOTES ON CYCHRUS AND THE SAD MISFORTUNES  
OF AN ENTOMOLOGIST\*

BY CHARLES DURY,

CINCINNATI, OHIO.

In regard to *Cychnus heros*, I have not seen one alive for years and only saved four from Kentucky, no two of which are alike. Over in Campbell Co., Kentucky, opposite Cincinnati, across the Ohio River, at one time they occurred in numbers. We laid flat stones along the edge of a bit of woods and got about seventy-five by going to the traps every day. The late Charles Siewers once had about twenty-five pinned on a board and put them in the warm oven to dry. His wife started a fire and roasted the whole bunch. He never remembered them until he smelled something burning. He lived near the locality and so was able to get many more than I did. I gave my duplicates away until only the four were left. After Siewers' death I never collected over there so don't know if they can be found there or not. I have taken single specimens in eastern Kentucky and near Chattanooga, Tennessee, but they differ from the Cincinnati form, which varies in color from bright deep blue to purple, and the thoracic shield is shaped differently. Mr. Ernest Shoemaker of Brooklyn, N. Y., sent me two *shoemakeri* from Virginia. They belong to this complex. Mr. H. P. Loding, of Mobile, gets them in north Alabama, though I don't know how abundantly. A long series from Virginia, Tennessee, Kentucky, and Ohio, will show that these are all the same species.

At Cumberland Gap, Tennessee, *Cychnus* were once abundant, but the last time I was there I found the country had been all burned over and I was able to find only one variety of *heros* and two other smaller species. On the Ohio side of the river *C. heros* is decidedly scarce, as are the other three species taken here, namely, *canadensis*, *lecontei* and *gemari*. I once chopped about

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\*These notes were originally sent to Warren Knaus, McPherson, Kansas, in the form of a letter.

thirty *gemari* out of a large log in Clermont Co., Ohio. Two years ago I visited the same woods, but did not find any, although the woods is yet intact. May and early June is their time.

After Siewers roasted his *Cychrus*, I went over one day and brought a box of specimens for him. To clear the small table, he placed a board on which he had pinned five or six *Cychrus heros* and a lot of *Dryobius*, collected the day before, on his chair. After looking at the things I had brought, he forgot his board and sat down on it! He jumped up with a yell, but the specimens were ruined, and the seat of his pants was bristling with pins and beetles. He was one of the most successful collectors I ever knew, but his material never benefitted him or anybody else.

## 1923 COLLECTION AND LIFE HISTORY NOTES ON STRATEGUS MORMON

By W. KNAUS,

McPHERSON, KANSAS

The writer has collected *Strategus mormon* Burm. for many seasons, in the Sandhill pasture region southwest and southeast of Medora, Reno County, Kansas, adjacent to the valley of Little River. The first season only two specimens were taken, but it was a season or two later before the species was recognized and was found to be in but few collections in the world. This knowledge made it desirable to collect, but success was variable. Some seasons none were found. Other seasons a half dozen or a dozen might be taken, but never enough to supply the demand. The season of 1922 yielded the most specimens up to that time, but 1923 was the record collecting season for this species. The first specimens were found about May 15, and the last ones were taken about July 6.

This past season, however, started abnormally early. A male specimen was picked up by a friend, Mr. Kenneth Krehbiel, about 18 miles south of McPherson, on April 8. No more were seen however until more than five weeks later when they began to appear in the horse and cattle pastures near Medora. Always the first specimens found were males. Careful observation the past season revealed that of the first thirty specimens taken in May, only 5 were females. After the tenth of June, the females increased rapidly, and by the twentieth of June the sexes were approximately equal.

My conclusion, after examining many burrows, is that the male appears from 5 to 15 days before the female. He selects the place for a burrow, choosing preferably a horse dropping from six months to a year old—nothing recent is attractive. He forces his way with his powerful head and fore legs into the sand or soil close beside or under the dropping, burrowing to a depth of from 4 to 12 inches according to the location and quality of the sand or soil. He does not throw the sand to the surface, but

packs it or crowds it outward from his body, until the hole is sufficiently large. At the bottom an enlargement is made, sufficient to contain the food, consisting of shredded horse or cow droppings, that is taken down the burrow by the female when she finds a mate who has built the house for the family. After the food for the future family is stored in the bottom chamber, and several eggs, between a sixteenth and an eighth of an inch in length, and a little more than a sixteenth of an inch in diameter have been deposited in the food mass, they either drive other burrows, and stock them, or move to a new location and set up another home.

Almost always in May and the first 10 days in June one male is found in the burrow. After that a female, and a male, and occasionally a female and two males, and rarely two pairs, may be found at the same location, but always two burrows are occupied. By the first week in July only an occasional female is found alive in the burrow and after that time, remains of dead *Strategus* show that the season is over. *Strategus mormon* is a day flier, his flight being somewhat slow and noisy. I have taken none at night, although many species of *Scarabeidæ* are exclusive night flyers. The season of 1923 yielded more specimens of *Strategus* in three or four pastures adjacent to Medora than had been taken in all the seasons previously.

## A COLOR FORM OF *CICINDELA REPANDA-UNIJUNCTA*

By W. KNAUS,

McPHERSON, KANSAS.

\* Recently I received from Mr. D. K. Duncan, of Globe, Ariz., a striking form of *Cicindela repanda-unijuncta*. The specimen is a male, slightly smaller than the average *unijuncta*, and bright green-blue in color.

The head, thorax and sutural area of the elytra, green, shading into blue-green around the white elytral markings, legs green, under side green to bluish purple. Except for the color, and size, it does not differ from typical *unijuncta*. Length 9 mm., width 3 mm.

To distinguish this color form, when other specimens come into the hands of collectors, I propose the name, *duncani*, in honor of the collector. The type specimen was collected near Phoenix, Ariz., and is now in my collection.

## GALLS OF *APION HIBISCI* FALL (COLEOPTERA)

At Seaside Park, New Jersey, on April 17, the old, globular galls of this species were noted on the dried stems of the swamp rose mallow *Hibiscus moscheutos* L. *Apion hibisci* was described by Prof. Fall in the "Journal of the New York Entomological Society" (Vol. XXVI, p. 219), in 1919, from specimens collected at Arlington, New Jersey, on rose mallow growing along the edge of a marsh and the Seaside Park record is the first since its description. Both localities are on the New Jersey coast some sixty miles apart. At the time the species was found at Arlington, a search was made for it on rose mallow growing at inland points of New Jersey but the results were negative.

H. B. WEISS.

## NOTES ON THE ORTHOPTERA OF THE EASTERN UNITED STATES

By W. S. BLATCHLEY,

INDIANAPOLIS, INDIANA.

Since my "Orthoptera of Northeastern America" appeared in May, 1920, a number of notes on the distribution, habits, etc., of certain species have accumulated. In order that our knowledge of this interesting order of insects may be kept somewhat up to date, I have brought these together in the present paper. I have also made brief mention of such new species and varieties as have been described by other authors from the territory covered by that work since its appearance. The serial number before the name of each species is that of the same species in the "Orthoptera."

(2). *Anisolabis annulipes* (Lucas). Since 1920 this earwig has been taken in numbers at Dunedin, Fla., from beneath and in decaying grape fruit and in piles of rotting unhulled rice.

(..). *Anisolabis* (*Euborellia*) *ambigua* Borelli. Hebard<sup>1</sup> has recently recorded the taking of a number of specimens of this West Indian form from beneath tidal litter along the edge of a mangrove swamp near Miami, Florida.

(10). *Doru aculeatum* (Scudder). While hunting near Indianapolis for *Donacia* on skunk cabbage, *Spathyema fætida* (L.), I took on May 1, 1921, 42 specimens of this earwig from between the bases of the leaves of the plants. They were below the surface of the ground, one to five in each clump of the plant, though usually in pairs, resting head downward in the groove which extends along the petiole of the leaf. Associated with them I found ten specimens of the chrysomelid beetle, *Donacia rufa* Say, and examples of several other species of beetles. I believe that the natural habitat of a number of our inland species of earwigs will be found to be between the base leaves and stems of grasses, sedges and other plants in damp localities.<sup>2</sup> From this retreat they emerge only at night in search of food.

<sup>1</sup>Trans. Amer. Ent. Soc., XLVII, 1922, 321.

<sup>2</sup>See Orthoptera of N. E. America, p. 57.



(39). *Arenivaga floridensis* Caudell. Two additional males of this Floridian roach have been found near Dunedin. They were taken in April while flying low along sandy roadways in the pine woods.

(57). *Manomera blatchleyi* (Caudell). W. T. Davis<sup>3</sup> has recently described an eastern race of this species under the name *Manomera blatchleyi atlantica*. His specimens (females only) were from Staten Island, Long Island, New York, New Jersey, Connecticut and Virginia. From typical *blatchleyi* it differs mainly in its broader and more tapering head, longer legs and shorter cerci.

(60). *Megaphasma dentricus* (Stal). The first known Indiana specimens of this giant walking-stick were taken at Wyandotte, Crawford County, on August 2, 1921. A male, 105 mm. in length, was found crawling slowly along a woodland path-way and two others on the ceiling of the hotel porch.

(64b). *Nomotettix cristatus floridanus* Hancock. The second known example of the long or caudate form of this grouse-locust was taken March 30, 1920, while sweeping herbage in a cypress swamp on the margin of Lake Istokpoga, Florida.

(76). *Paxilla obesa* (Scudder). A single male of this bulky species was swept from the same swamp at Lake Istokpoga. It was the first specimen I had taken personally during all my collecting.

(79.) *Tettigidea armata* Morse. A female of this form was taken at Moore Haven, Florida, on March 24.

(102). *Ageneotettix deorum* (Scudder). The known range of this species has been extended eastward by Hubbell,<sup>4</sup> who records the taking of a specimen at Three Oaks, Michigan.

(105). *Mecostethus platypterus* (Scudder). A number of specimens taken at Cambridge, Nebraska, July 19, 1921, have been sent me by A. P. Morse. Not before recorded west of Iowa and Minnesota.

<sup>3</sup>Journ. N. Y. Ent. Soc., XXXI, 1923, 52.

<sup>4</sup>Occasional Papers of the Museum of Zoology, Univ. of Mich., No. 116, 39.

(145). *Hesperotettix pratensis* Scudder. I was surprised to find, on August 4, 1921, several specimens of this handsome little locust by the side of a roadway running along a high wooded ridge near Wyandotte, Crawford Co., Ind. This county is in the extreme southern end of the State, adjoining the Ohio River. The only other Indiana localities previously known were in Lake County, adjoining Lake Michigan, where it occurs only in swales or low marshy tracts between the sand dunes. The tegmina of these southern upland examples were shorter than in those from the marshlands of the North, but the form of prosternal spine, of hind margin of metazona and of supra-anal plate of male are very distinctive in the species and differ conspicuously from those of *H. brevipennis* (Thos.).

(160). *Melanoplus viridipes* Scudder. Morgan Hebard,<sup>3</sup> of Philadelphia, has, both in Mss. and in print, taken occasion to caustically criticise my treatment of this and allied species, and has described (loc. cit.) a new eastern race. *M. v. eurycercus*, using in part as cotypes, material I furnished him from Indiana. As stated by me in my notes on this species (p. 367 of the "Orthoptera"), some of the cotypes of Scudder's *viridipes* came from a colony discovered by me in Vigo County, Indiana. One of Morse's cotypes of *M. deceptus* came from this same colony. The species occurs mainly in isolated colonies of 30 to 70 or more in open blue-grass wooded pastures. It is very probable that these colonies emerge from one or two egg masses deposited by the same female. From such a colony occupying not over 100 square feet in a pasture of Marion County, Indiana, I have taken numerous examples which showed all the variations of the male cerci on which were based the three forms, *viridipes* Scudder, *deceptus* Morse, and *eurycercus* Hebard. The females of these forms are absolutely inseparable, as is admitted by Hebard (loc. cit., p. 394). If the egg pods of a single female, or of two or three females which originally came from the same colony, give rise to males whose variation in cerci is such as to lead to the founding of three species or races, where is the hair-splitting of nomenclature to end?

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<sup>3</sup>Trans. Amer. Ent. Soc., XLVI, 1920, 357, 393.

Hebard (loc. cit., p. 393) states that "from over the wide range of *viridipes* eastward from Lake Co., Indiana, not a single male before us shows a cercal development intermediate in character between the typical condition of *viridipes* and *eurycercus*"; yet on the very next page he says "the males before us from Ann Arbor, Michigan, are intermediates, referable to *v. eurycercus* but showing distinct variation toward *v. viridipes*." Ann Arbor is 165 miles east of Lake Co., Indiana.

Hubbell (loc. cit., p. 50) states that all but two of the 31 males of *viridipes* taken by him in Berrien Co., Michigan, are of a type intermediate between typical *viridipes* and *eurycercus*. Although I may not be able, as Hebard claims, "to recognize the true value of species or races wherever finesse or elaborate analysis is necessary," I do not believe in trammeling nomenclature by giving a new name to every individual that has an extra spot on its side or an extra curve in its tail.

(..). *Melanoplus calloplus* Hebard. Under this name Hebard (loc. cit., p. 398) describes and refers to the Gracilis Group a form from Collison Ridge, Bath Co., Virginia, which he calls "an annectant type between *M. similis* Morse and *M. viridipes* Scudd."

(..). *Melanoplus alabamæ* Hebard. This name is given by Hebard (loc. cit., p. 374) to a form taken at Evergreen, Conecuh Co., Alabama. He states that it is very closely related to *M. querneus* R. & H., "differing apparently in the slightly smaller size and slightly more slender form, but strikingly in the shape of the male cerci."

(..). *Melanoplus tunicæ* Hebard. From Strickton, Rankin Co., Mississippi, Hebard (loc. cit., p. 370) describes a form under this name. He states that it differs from *Melanoplus ponderosus viola* Thos. in its "slightly more slender form, average longer tegmina, usually somewhat more solid coloration and distinctive male cerci."

(194). *Melanoplus flavidus* Scudder. Hubbell (loc. cit., p. 53) records this species from Berrien Co., Michigan, this being its most eastern known station and the first record for that State.

(258). *Orchelimum volantum* McNeill. The known range of this species has been extended eastward to New Jersey by Dr. H. Fox<sup>6</sup>, who took specimens near Rancocas and Delanco, that state, in August and September, 1920. Its most eastern station hitherto recorded was Cedar Point on the shore of Lake Erie, Ohio.

(264). *Conocephalus nemoralis* (Scudder). This species has been taken in Berrien Co., Michigan, by Hubbell (loc. cit., p. 65), this being the first and only record for that State.

(269). *Conocephalus attenuatus* (Scudder). Dr. Fox reports (loc. cit., p. 268) the taking of this meadow grasshopper at several localities in New Jersey. Its former most eastern station was Cornwells, Pennsylvania.

(273). *Conocephalus viridifrons* Blatch. According to Hubbell,<sup>7</sup> this little meadow grasshopper occurs in numbers in the eastern part of North Dakota, where it was found in dry fields and pastures in company with, but even more numerous than, *C. fasciatus* (DeGeer).

(337). *Oecanthus exclamationis* Davis. In fulfillment of my prediction (p. 719 of the "Orthoptera") that this species "doubtless occurs in Indiana," specimens were taken in Knox County September 13, 1920, and July 5, 1921; also in Marion County in July and August of the latter year. All were swept from low shrubs in dense woodlands.

(.). *Oecanthus nigricornis argentinus*? Saussure. Among specimens of *O. n. quadripunctatus* taken in Knox Co., Indiana, on Sept. 18, 1922, I found several having a shorter, broader body than that variety and with the outer black mark on basal joint of antennæ larger and set almost at right angles to the inner one; while the two on the second joint were shorter, thicker, subequal in length and with their lower ends converging to form a rough V. As I could not determine them satisfactorily from the literature at hand, I sent them to A. N. Caudell of Washington, who wrote that "they are what I call *O. nigricornis* var. *argentinus*

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<sup>6</sup>Ent. News, XXXII, 1921, 265.

<sup>7</sup>Occasional Papers of the Museum of Zoology, Univ. of Mich., No. 113, p. 49.

Sauss.", and he stated that he had specimens from a number of the Western States and from Delaware; also that breeding, as shown by Houghton<sup>8</sup> had proven them to be intermediate between typical *nigricornis* Walker and *quadripunctatus* Reut. That this is their status, there is probably no doubt, but that they are the form described by Saussure from La Plata, Argentina, is strongly problematical. His description<sup>9</sup> calls for a species very similar to *O. nivicus* but having joints 1 and 2 of antennæ with a *single* black line beneath. He afterward treated a species under that name more fully in the "Biologia" (1897, p. 263, not to me now available), where, according to Caudell,<sup>10</sup> there was "considerable variation from his original description in the length of the wings and the marking of the antennæ." As Caudell originally determined the United States form from Texas specimens and from the Saussure literature without comparison with the types, he may have been mistaken in its naming, as he infers when he says "specimens of what I take to be this species," etc. As individuals with the peculiar markings of the antennæ, as described above, will probably be found at various points in the Eastern States, I have mentioned these facts in order that they may be properly placed.

(341). *Neoxabea bipunctata* (DeGeer). Within the past three years this species has been taken in some numbers in Knox, Putnam and Marion Counties, Indiana, while sweeping vegetation in low alluvial woodlands along streams. At the time of writing the "Orthoptera" I had taken but two specimens in over thirty years' collecting in that state.

(349). *Hapithus agitator* Uhler. A female of this species with a pupal case of a parasite, almost as large as the body of the host, attached to the abdomen, was taken in Knox Co., Indiana, Sept. 18, 1922. Through Mr. Caudell the parasite was determined by Mr. Rohwer as probably the hymenopteron, *Rhopalosoma poeyi* Cresson. Specimens of that parasite from the same species of cricket have been reared by J. D. Hood of Washington, D. C.

<sup>8</sup>Ent. News, XX, 1909, 274; Can. Ent., XLI, 1909, 113.

<sup>9</sup>Mission Scientifique au Mexique, 1874, 460.

<sup>10</sup>Proc. Ent. Soc. Wash., V, 1903, 166.

## CORRECTIONS AND COMMENTS HEMIPTERA-HETEROPTERA

By H. G. BARBER,

ROSELLE, N. J.

In the course of time, since the publication of Van Duzee's Catalogue, I have made note of some corrections and changes which it is necessary to make in certain of my articles. Some of the errors are typographical, due either to lack of opportunity to read proof or to read it with sufficient care.

1911—Jour. N. Y. Ent. Soc. XIX, p. 27. Dr. Bergroth, Proc. Roy. Soc. Victoria (N. S.), Part I, p. 15, 1916, in a foot-note remarks that "the North American *Esuris castanea* Barber does not belong to this genus is clear from several characters." From further study of two macropterous specimens, not discovered at the time of making the original description, I am inclined to agree with this conclusion.

**Neosuris**, new genus.

The entire body is somewhat shining and for the most part closely and distinctly punctate, the punctures set with fine inclined hairs. The head is wider than long, closely and evenly punctate; ocelli absent in the brachypterous form, set far apart and close to the eyes in the macropterous form. Antennæ mediocre with basal segment short, surpassing the head by one-half its length, terminal segment slightly incrassate. Rostrum with the first segment about reaching the base of head, nearly as long as second which is a little shorter than the last two taken together. Pronotum with the lateral margin dorso-ventrally obtusely rounded, not carinate; the propleuræ punctate within the lateral margins; in the brachypterous form the pronotum is widest before the middle from whence it is gradually contracted posteriorly, narrowest just before apical margin, with no evidence of a transverse sulcus, evenly and closely punctate except along apical and basal margins; in the macropterous form the anterior lobe is not set off from the posterior lobe by a sulcus, the former nearly twice as long and somewhat narrower than the latter which is differentiated by its coarser and sparser punctation; the posterior margin is lightly arcuated. The scutellum is almost an equilateral triangle, somewhat elevated across the base and evenly punctate. The hemelytra are rather coarsely and evenly punctate throughout. In the brachypterous form the clavus and corium are connate and level with the scutellum, with the suture between indicated by a line of punctures; the area of the clavus provided with about four irregular rows of punctures; the corium is

enervose; the membrane is represented only by a very narrow border along the obliquely truncated margin. In the macropterous form the membrane reaches the apex of the abdomen with the clavus distinctly demarked and provided with three regular rows of punctures; commissure about one-half the length of the scutellum. The anterior femora are rather strongly incrassate and armed beneath with a few small teeth; the anterior tibiae are considerably curved and expanded at apex; the intermediate and posterior femora are moderately incrassate; the posterior tarsus with the basal segment much longer than the last two taken together.

Type *Neosuris castanea* Barber.

1911—Journ. N. Y. Ent. Soc. XIX, 29. I can not concur in the conclusion of Prof. S. B. Fracker (Ann. Ent. Soc. Amer., xi, 270-271, 1918) that my *Alydus rufescens* is a variety of *A. conspersus* Montandon. It is no doubt very closely related to Montandon's species but its general facies, behavior and range are sufficiently striking I believe to mark it as a distinct species even if the genitalia are of the same general type. In this subfamily, as in many of the *Coreidae*, the genitalia are subject to a great deal of variation, quite as much in fact as any other bodily parts. The pronotum is more deeply punctate and much less pilose in *rufescens*. The differences in coloration are very striking.

1914—Bull. Am. Mus. Nat. Hist. XXXIII, 509, line 22, change *Lygæus albulus* Dist., to *Lygæus tripunctatus* Dallas.

1914—Journ. N. Y. Ent. Soc. XXII, 167, line 5 in the synopsis of the species should read—pronotum much longer than wide.

1918—Proc. Ent. Soc. Wash. XX, 108, line 6 from bottom should end as follows: beyond apex of head. Line 5 from bottom should begin: Fore femora. Page 109, line 14 from bottom should read: collected by H. S. Barber.

1918—Psyche XXV, 74, line 9 from bottom should read: *Myodocha* Latr. Page 78, last line. *Neosuris* Barber. Page 81, line 18, should read: *Plinthisus* Fieb.

1918—Journ. N. Y. Ent. Soc. XXVI, 51, line 13 should read: *Neosuris* Barb. I believe that *Esuris fulgidus* is correctly placed.

1918—Bull. Bklyn. Ent. Soc. XIII, 37, line 26 should read: collected by Mrs. W. P. Cockerell. Professor Cockerell writes me that he published a note concerning this *Blissus occidentis* in Ent. News XVI, 308, 1905, in which he pointed out the characters.

1914—Bull. Am. Mus. Nat. Hist. XXXIII, 513; 1921—Journ. N. Y. Ent. Soc. XXIX, 114. I have recently seen a mature female specimen of *Ligyrocoris slossoni* taken by Professor W. S. Blatchley at Dunedin, Florida. There is no doubt that it represents a distinct species and my description of the species in the first-named publication, based upon an imperfect and immature specimen, may be amended in some particulars. The head is reddish-castaneous; the eyes so placed that the lateral post-ocular part of the head is subequal to the space between the eyes and the apex of the antenniferous tubercles; the post-ocular part being gradually contracted. Pronotum constricted just back of the middle, with the anterior impunctate lobe only a little longer than the posterior lobe, the former piceous very sparsely setose, the latter reddish-castaneous, sparsely and irregularly punctate, with faint traces of four paler longitudinal fascia; the collar reddish. The sternum piceous with the acetabulæ and posterior angle of propleura paler. The femora are castaneous, paler towards the base. The scutellum is dull piceous, pale at apex, punctate only along sides towards apex. The corium is pale stramineous rather heavily marked with fuscous as follows: an irregular post-median transverse fascia which incloses two pale spots close to the apical margin of corium, the outer sub-apical one is much larger and sparsely punctate with ferrugineous; the apex of the corium infuscated; the area before the transverse fascia as well as the clavus streaked with fusco-ferrugineous, leaving the extreme base, the costal margin to well beyond the middle and several discal streaks pale. Length of female 6.5 mm.

This species should be placed in my key in section 15 close to *sylvestris*.

1921—Proc. Ent. Soc. Wash. XXIII, 66 and 68. *Lygæus niger* should read *rubriger*.

1922—Circular No. 54, N. J. State Dept. Agric., p. 16, No. 7, should read: *Corythucha pallipes* Parshley. Page 17, line 11, should read: (=parshleyi Gibson). Page 17, line 31, and page 22, line 17: *Baptisia* misspelled. Page 23, line 17 from bottom, should read: =? *lurida* Stal vide Parshley.



1923—American Mus. Novitates No. 75. Dr. Bergroth has called my attention to two necessary corrections in my paper on the Hemiptera of Porto Rico. *Orthæa intermedius* n.n. for *feruginosa*, preoccupied.

**Neogorpis**, new genus for *Gorpis neotropicalis*.

The body is more slender than in *Gorpis*. The head is elongate, cylindrical and correct, subequally long as the anterior lobe of the pronotum; anteocular part of head much longer than the postocular, the latter more swollen; ocelli absent. Rostrum shorter than in *Gorpis* reaching only to apex of prosternum, second segment about one-third longer than third. Antennæ long and slender, inserted midway between apex of head and eyes, first segment nearly as long as head and anterior lobe of pronotum together and about two-thirds as long as second segment, the last two segments capillaceous, with the first of these much longer than the ultimate. Pronotum dull, not pilose, much longer than wide; collar very wide, not sharply delimited; anterior lobe a little longer and little narrower than the posterior lobe, impunctate; humeral angles unarmed. Scutellum swollen, elongate, impunctate, almost twice as long as wide, apex not laterally contracted, slightly obtuse. Hemelytra very elongate, a little longer than the abdomen, impunctate, very convex, parallel sided; commissure about four times as long as scutellum; membrane not plainly demarked from the corium, the latter provided with two veins the inner one forked opposite to apex of commissure; veins of the membrane very faint. Propleuræ as seen dorsally much dilated; anterior acetabulæ excised before middle of prosternum, closed behind; anterior coxæ elongate; legs elongate with the anterior femora somewhat incrassate, densely setose beneath and provided with a few small teeth; anterior tibia slightly shorter than the femora, very slightly curved and provided inwardly through entire length with small acute oblique spines; apex of posterior femora not incrassate nor nearly reaching to apex of hemelytra.

Genotype: *Neogorpis neotropicalis* Barber.

Dr. C. J. Drake, to whom I have sent specimens of Porto Rican Tingidæ, has informed me of the following errors: page 6, *Athæa pallidus* is a synonym of *Leptopharsa illudens* Drake. Page-12, *Corythaica moncha* Stal should be *Corythaica planaris* Uhler. Page 13, *Teleonemia prolixa* Stal is *Teleonemia sacchari* Fab. Add to the list of Porto Rican Tingidæ: *Monanthia monotropida* Stal.

1923—Univ. Iowa Stud. in Nat. Hist. 10, No. 3, pp. 24, 25.

In comparing *Dysdercus howardi* Ballou with *ruficollis* Linn., I find that I was in error as to the identity of Linnaeus' species.

*D. howardi* is a little larger than *D. ruficollis* and considerably wider with the lateral margins of the pronotum expanded and considerably reflexed throughout. The head, anterior lobe of pronotum, except the collar which is whitish, lateral margins and legs reddish. Posterior lobe, except the disk posteriorly, lateral margins and the corium ochraceous. The pronotum is one-third wider than it is long, with the posterior lobe three times as long as the anterior lobe, exclusive of the collar. The antennæ and rostrum are broken off. Page 18, line 4. Change *Corcocoris* to *Corecoris*.

1923 — Guide to the Insects of Connecticut, Hemiptera-Lygæidæ: p. 723, line 11, and p. 724, line 34: *Myodochus* Latr. should read *Myodocha* Latr.

## ON A FEW NEW AND OLD CHRYSOMELIDÆ

BY CHARLES SCHAEFFER,

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In the list of Chrysomelidæ, which I accepted to furnish for the list of insects of New York State to be published in the near future by Cornell University, appear a few new names necessary on account of misidentifications, which, though known to me for some time, I have neglected to publish so far. In the species of *Donacia* occurring in New York and elsewhere I have been compelled to make quite a number of changes, but these, I hope, will be published in a revision of the North American species of *Donacia* sooner than the list will appear.

*Phytodecta pallida*, Linn.

This is supposed to be the common species of the genus with quite a wide distribution, but is certainly not identical with the European species.

Kirby, 1837, first recorded the species from Canada as the European *rufipes*. Crotch, 1873, rejects this identification and says that it is the same as the European *pallida* and also places *simplex* Suffr., as synonym of the former.

Comparing our insect with the descriptions and specimens of the European *pallida*, kindly sent me by Mr. Julius Weise of Germany, made it quite clear that the two are different species. Our American insect is a true *Phytodecta*, while the European *pallida* belongs in the subgenus *Spartophila*, and besides other differences the latter species has the elytral punctures coarser and the sixth and seventh outer striæ confused about the middle, in our American insect the punctures are much finer and all the rows regular.

Mr. Howard Notman gave an interesting note in Bulletin Brooklyn Entomological Society, p. 75, on collecting two apparently different species of *Phytodecta*. One, which he identified as *affinis* (*arctica*) he took only on willow, the other which he called *pallida* occurred only on poplar. These latter specimens were smaller and generally less heavily marked especially on the pro-

thorax, and extracting the genitalia of the male of each he found them to be entirely different. Mr. Notman kindly loaned me his specimens of both as well as the genitalia and I have tried to find a good external structural character to support the great difference in the genitalia. In this I did not succeed, but there is a difference in the two in regard to the coloration of the head. In the larger specimens, which he called *affinis* (*arctica*) the head is always bi-colored, that is the posterior part is black and the anterior part reddish, even in specimens in which the thoracic and elytral maculations are largely confluent. In the smaller specimens, his *pallida*, where the elytral and especially the thoracic maculation is smaller, the head is entirely black with occasionally a more or less distinct reddish spot between the eyes on each side of middle. Both are not *arctica* nor *pallida*.

**Phytodecta americana**, new species.

*Phytodecta rufipes*, Kirby, Fauna Bor. Am., p. 213.

*Chrysomela rufipes*, Rogers, Proc. Acad. Nat. Sc., Phil., vol. VIII, p. 35.

*Gonioctena pallida*, Crotch, Proc. Acad. Nat. Sc., Phil., vol. XXV, p. 52.

*Phytodecta affinis* (*arctica*), Notman, Bull. Brookl. Ent. Soc., vol. XVI, p. 75.

Reddish yellow, including legs and antennæ; head above, two large triangular basal spots, generally largely confluent basally, scutellum and five large spots, two subbasal, one laterally at about middle and two subapical, black, the elytral spots often more or less confluent or elytra black with basal, sutural, apical and lateral margins reddish; body beneath black, the last or the two last ventral segments more or less reddish yellow. Head sparsely punctate, punctures slightly smaller at middle; third joint of antennæ not as long as the next two. Prothorax strongly transverse, about twice as wide at base as long at middle; sides feebly arcuate; basal angles rectangular, acute, anterior angles broadly rounded; surface sparsely and finely punctate, with a few much larger punctures intermixed, the punctures laterally still coarser. Elytra slightly wider behind middle; punctures of the regular rows moderate; intervals finely and rather sparsely punctate. Ventral segments sparsely punctate, punctures moderately coarse. All the tibiæ with a distinct tooth near apex, the tooth of front tibiæ generally not as large as those on middle and hind tibiæ. Length 5.5-6 mm.

Type from Keene Valley, Essex Co., N. Y. (Notman). Other specimens seen are from Rockaway Beach, Long Island (Schott); Derrick City, Pa. (Davis); Duluth, Minn.; Prince Edward Co.,

Ont.; Medicine Hat, Alberta (Carr). Two paratypes are in Mr. Notman's collection.

This species is very close to the European *rufipes* and except for slightly smaller size and the elytral intervals sparsely punctate it scarcely seems to differ otherwise.

*Phytodecta notmani*, new species.

*Phytodecta pallida*, Notman, Bull. Brookl. Ent. Soc., vol. XVI, p. 75.

Very much like *americana* in form, coloration, and sculpture of prothorax and elytra except being slightly smaller, the black spots on the prothorax small, never triangular, about the size of the scutellum, but less elongate and the head is black with often a more or less distinct reddish spot on each side of middle between the eyes. Length 5-5.5 mm.

Keene Valley, Essex Co., N. Y., collected by Mr. Howard Notman, to whom I am indebted for specimens; two paratypes are in Mr. Notman's collection.

The North American species of *Phytodecta* may be readily identified by the following table:

1. Third antennal joint as long or longer than the two following joints; femora black, tibiæ bicolored.....*arctica* Mann.  
Third antennal joint shorter, not as long as the two following joints, legs black or entirely pale.....2
2. Legs black, intervals of elytra rather closely punctate, outer joints of antennæ black.....*viminalis* Linn.  
Legs and antennæ unicolorous pale; intervals of elytra sparsely and finely punctate.....3
3. Thoracic spots large, generally triangular and very often transversely confluent; head bicolored, anterior part pale, posteriorly black .....*americana* Schffr.  
Thoracic spots small more or less subquadrate, never triangular, about as large or smaller than the scutellum; head black, occasionally with a more or less distinct, small, pale spot on each side above the antennal insertion.....*notmani* Schffr.

*Phytodecta arctica* Mann. has been compared at various times with the European *nivosa*, *linnæana*, *triandra*, and *affinis*. If it is the same or a variety of any of these remains to be confirmed by a close study of specimens of all these species. The European *viminalis* is once recorded from Alaska but to my knowledge there is no other record nor are there apparently any North American specimens in our collections. *Phytodecta simplex* is described

from North America by Suffrian as "testacea, antennis apice nigricantibus, elytris profunde punctatostriatis, tibiis anticis muticis, mediis fortiter calcaratis." I have not seen anything that agrees with this. If Suffrian's specimen came really from North America then it is the only one of our species which belong in the subgenus *Spartophila* and apparently closely allied to *pallida*.

***Disonycha davis*, new species.**

Similar to *caroliniana* but slightly stouter and shorter with less oval elytra and femora more or less distinctly infusate. Head with a few coarse punctures near each eye which extend nearly to the middle; frontal tubercles well limited below; antennal joints short and rather stout. Prothorax strongly transverse; basal angles distinct but obtuse; anterior angles oblique; surface distinctly punctate. Elytra at base not wider than the thorax at base; sides feebly arcuate; surface distinctly punctate with moderately large punctures. Ventral segments of abdomen moderately closely punctate. Length 5.25-6.75 mm.

Anglesea, N. J., June (type); New Brunswick, Vineland and Lahaway, N. J.; Wyandanch and Yaphank (Davis), Long Island, N. Y.; Kansas; Onah, Manitoba (Wallis).

I have compared this species with the more common *caroliniana* but it agrees in form, antennal structure, thoracic and elytral punctuation much better with *arizonæ*. This latter, however, has the abdominal segments very sparsely punctate.

This is very likely one of the forms or species included by Dr. Horn under his *crenicollis*, which latter, as I have suggested in Journal New York Entomological Society, Vol. XXVII, p. 334, is not that species but *fumata* Lec. I have since seen Dr. Le Conte's type and my surmise of the wrong identification of *fumata* proved to be correct.

The infusate femora are by no means constant, in some specimens the hind femora at least are reddish, but then generally the two anterior pair are more or less clouded. One specimen has all the femora dark. The marginal vitta of elytra in all my specimens attains the sutural vitta.

***Disonycha asteris*, new species.**

Above flavous, head posteriorly, labrum, antennæ, spots on prothorax, scutellum, a sutural, discal and marginal vitta black, the latter attaining the sutural vitta; body below black except prothorax, two or three of the

apical segments of abdomen and femora, which are reddish or flavous. Head smooth at middle a few coarse punctures near each eye; tubercles divided by a moderately deep impression. Antennæ reaching to about middle of elytra; joints rather elongate and somewhat stout, similar to those of the common eastern form of *quinquevittata*. Prothorax about twice as wide as long; sides feebly arcuately narrowing to apex; basal angles obtuse, blunt; anterior angles oblique; surface alutaceous, finely and sparsely punctate. Elytra at base not wider than thorax at base; sides feebly rounded; surface finely punctate. Body below alutaceous; abdominal segments moderately closely and somewhat finely punctate. Length 6-7 mm.

Stonewall (type), Aweme, Winnipeg, Manitoba (J. B. Wallis); Edmonton and Medicine Hat, Alberta (F. S. Carr).

Two paratypes from Stonewall are in the collection of Mr. Wallis, who sent me the first specimens quite some time ago. These specimens were taken on white aster in a swamp, according to the label on the specimens.

This will be readily known from all vittate *Disonycha*'s with closely punctate ventral segments by the first two, three or four dark ventral segments except *latifrons* from Arizona and Colorado, which has the frontal tubercles of the head flat, even with the rest of the surface and only indicated by finely impressed lines and the elytral vittæ are generally also narrower. *D. fumata* Lec. (*crenicollis* Horn not Say) has also the ventral segments occasionally slightly infuscated, but in this species the femora are generally more or less fumate, the frontal tubercles are much more prominent and the antennal joints are much narrower and more elongate. Although they occur in widely separated localities, both *asteris* and *latifrons* are very close and do not differ very much from each other.

*Haltica betulæ*, new species.

Slightly shorter and a little more convex than *carinata* Germ. (*ulmi* Woods), color green metallic; prothorax and elytra finely alutaceous, feebly shining. Antennæ about half the length of the body or slightly longer, black with a feeble greenish tint, third joint slightly shorter than fourth, tenth joint slightly shorter than twice longer than wide. Head smooth above; eyes rather small, not as wide as half the space between the eyes; tubercles limited above by a distinctly impressed line, above which are sometimes a few punctures; near the eyes an area of somewhat large punctures. Prothorax a little wider at base than long; sides

parallel from slightly above middle to base, anteriorly slightly narrowing towards apical angles; surface rather indistinctly alutaceous, feebly shining and very feebly punctate, ante-basal groove deeply impressed and entire. Elytra slightly wider than the prothorax at base, distinctly alutaceous and generally duller than the prothorax, finely and rather sparsely punctate, to punctures more indistinct or absent towards apex. Body beneath and legs with greenish metallic lustre; elytral epipleuræ terminating at or slightly beyond the apex of the second ventral segment. Length 3-3.75 mm.; width about 1.5-2 mm.

Oliveria, Catskill Mts., N. Y.

A small number of specimens were taken at the above locality on June 18 and 21 on the leaves of birch by Mr. Ernest Shoemaker, in which collection is also a paratype. He informs me that they were very numerous on the leaves of birch but collected only a small number.

This species is readily known from all our species by its short elytral epipleuræ. In all our *Haltica*'s, as far as I know them, the elytral epipleuræ terminate at the apex of the fourth ventral segment, while in *betula* the epipleuræ terminate at the apex of the second ventral segment, in only two of the twenty-five specimens examined it extends almost to the third segment. *H. woodsi*, another green species, is a little smaller, with the elytra more shining, more coarsely punctate and the lateral margin of prothorax near apical angles slightly more incrassate and oblique.

### *Haltica ignita*, Ill.

Until recently no small *Haltica* was known that did agree with the description of *ignita*, that is in regard to the possession of a lateral elytral plica. Mr. Fall in *Psyche*, vol. XXVII, p. 106, calls attention to three specimens received from Dr. Chittenden of which the female has, as he says, "a tolerable well defined lateral elytral plica," and further on says that it might serve very well for the type of Illiger's description. For a number of years I have had five specimens of possibly the same thing, males and females, which I had labelled *ignita*. Two were labelled "N. Y.", two from Pine Island, N. Y., and one West Point, N. Y. They all show a more or less distinct lateral elytral plica in both sexes, which is always more strongly defined towards its apex than at middle and towards base, where it is faint or absent. In the list



of Chrysomelidæ above referred to these are listed as *H. ignita* Ill. and I do not see any reason to do otherwise as they agree very well with the description. Some of the specimens have the head, prothorax and underside with a metallic green or greenish-blue tint. In addition to the above localities I have seen specimens from South Carolina and Alabama, which are in Mr. Liebeck's collection.

***Haltica liebecki*, new species.**

Form of *californica*, color bluish purple to reddish; scutellum more or less distinctly metallic green; antennæ black with a slight brassy tint. Head smooth, very finely alutaceous and feebly shining; eyes, as seen from the front a little smaller than half the space between the eyes. Prothorax slightly wider at base than long at middle, sides feebly narrowing towards apex and narrowly reflexed; surface finely punctate with a few coarse punctures in a short oblique space near the apical angles; ante-basal impression entire or nearly so, finely impressed at middle, more deeply at sides. Elytra oval, at middle less than twice as wide as the prothorax at base; surface finely not closely punctate, the punctures generally a little larger than those on prothorax, intermixed finer punctuation scarcely evident. Body beneath alutaceous, of the same color as above, but occasionally more bluish or even greenish. Last ventral segment of male with a deep and relatively wide median impression at apical half. Length 4-4.5 mm.

Huachuca Mts., Arizona.

This species is closely allied to *californica* in form but has shorter and stouter antennal joints. I had placed *liebecki* for a time doubtfully as *vicaria*, but specimens of the latter species kindly sent me by Mr. Liebeck differ in being of more elongate form with less oval elytra.

***Haltica cuprascens* Blatchley**

Through Mr. Blatchley's kindness I have seen the type and one of the co-types of *cuprascens* and according to these it is not what Mr. Fall in *Psyche*, Vol. XXVII, p. 103, identifies as that species, but is apparently what he describes on p. 108 as *H. purpurea*. His description of the latter species at least agrees very well with the types of *cuprascens*. The *cuprascens* of Mr. Fall is what Dr. Woods in his paper on the Maine *Haltica*'s records wrongly as *torquata* and for which later on Malloch proposed the name *sylvia*, which name will stand for this species.

***Haltica evicta shoemakeri*, new variety.**

Differs from typical *evicta* in having the elytra dull and more finely punctate. Length 4 mm.

Plattsburg, N. Y. (type); Catskill Mts., N. Y.; Stephenville, Bay St. George, Newfoundland (Engelhardt); Frankonia, N. H.; Illinois.

The New York specimens were collected by Mr. Shoemaker and that from the Catskill Mts., a paratype, is in his collection. The two specimens from New Hampshire and Illinois are in Mr. Liebeck's collection.

This is apparently the extreme eastern form of the typical western *evicta*. My twelve specimens of the typical insect, which are from British Columbia, Oregon and Washington, are all shining and more coarsely punctate.

***Chalcoides helxines violacea*, Melsh.**

These are the purple or bluish-red specimens, which also have the posterior femora in great part or entirely dark. The form is apparently a little more robust than in the typical insect and the ante-basal groove of prothorax is frequently less deeply impressed. I am also under the impression that this form feeds on a different plant than the typical form. In view of all this I think it is entitled to recognition.

THE GENUS *MECHANITIS* FABR.,  
(LEPIDOPTERA, ITHOMIINÆ)

BY W. T. M. FORBES,

DEPARTMENT OF ENTOMOLOGY, CORNELL UNIVERSITY

The Cornell Entomological Expedition of 1919-1920 obtained an exceptionally good representation of this genus, which has been supplemented by material already in the University Collection, several species from the Schaus collection, through the kindness of Mr. Schaus, and material purchased from W. F. H. Rosenberg and Staudinger and Bang-Haas. Altogether, most of the recognized forms of *Mechanitis* are at hand. The collections of the United States National Museum, the American Museum of Natural History, and the Carnegie Museum, at Pittsburgh, have also been consulted, and have given opportunity to see a few more forms, and have demonstrated the range of variation with long series from various parts of South America.

There has never been a systematic study of the species and forms of *Mechanitis*, and no attempt at a key, nor examination of the structural characters. In the only revision of the genus, by Haensch in Seitz's "Macrolepidoptera of the World," the forms are not even divided into natural groups.

*Mechanitis* is one of a little group of genera of Ithomiinæ characterized in the male by the rudimentary fore tarsi, apparently four-branched (or even five-branched) Cu in the fore wing, Sc and R of hind wing closely parallel at the base, and lobed costa of the hind wing. In the female the same group is unique among the butterflies in having Sc and R not merely closely parallel, but actually fused, out to the middle of the cell; and Cu is apparently four-branched, as in the male. The three genera may be separated as follows:

*Mechanitis*: Male fore femur full as long as coxa, its tip normally lying in the groove between eye and thorax, or at most a little below the eye; cell of hind wing normally about three-fourths length of wing, with the discocellular markedly angled and transverse; female with Sc arising from cell near its middle, and spur of media attached to lower discocellular in fore wing.

*Scada*: Fore femur shorter than coxa, the tip when folded lying far below the eye; cell of hind wing two-thirds as long as wing, the discocellular erect and straight or moderately angled, and the upper long and longitudinal; female with Sc arising from cell near middle, and spur of media attached to middle discocellular or opposite  $M_2$ . Small translucent species.

*Sais*: Fore femur as in *Scada*; cell with its apex reaching almost to margin, and obliquely cut off at end, mdcv. and ldcv. continuing the general line of Cu, and udcv. very short; female with Sc arising from cell near its apex, and cell shaped about as in male.

*Heteroscada* is synonymous with *Scada*, being based on males of *Scada* and females of *Episcada*.

On genitalic characters only two species can be separated from the general mass of the genus, *M. equicola* and *M. truncata*. I suspect *M. proceris* may also be structurally distinct, but have only a specimen without an abdomen. It is hardly conceivable that all the other forms are a single species, especially as frequently two or three are found in a single locality without intergrading, so I have grouped them as ten species in the following list, recognizing that the number may be reduced still more when the biology is known:

1. *equicola* Cr., with var. *equicoloides*.
2. *truncata* Btl., with varieties *juntana*, *olivencia* and *huallaga*.
3. *proceris* Weym.
4. *polymnia* L., with varieties *chimborazona*, *caucaensis* and *casabranca*.
5. *mazeus* Hew., with vars. *nigroapicalis*, *jurimaguensis*, *phasianita*, *lucifera*, *pannifera*, *fallax*, *messenoides* and *deceptus*.
6. *eurydice* Stgr., with var. *doryssides*.
7. *doryssus* Bts., with vars. *veritabilis*, *labotas*, *utenaia* and *saturata*.
8. *macrinus* Hew.
9. *lycidice* Bts., with var. *isthmia* and ab. *arcana*.
10. *franis* Hew., with var. *menapis*.
11. *manineus* Hew., with an undescribed variety.
12. *elisa* Guer., with var. *ocona* and ab. *meneclis*.

13. *lysimmia* F., with vars. *nessaea*, *sulphurescens* and *albescens*.

I have a suspicion in particular that *polymnia*, *mazæus*, *dorysus* and *eurydice* are all one species, but the presence of *eurydice* in the same region with forms of *mazæus* makes a difficulty unless there is Mendelian inheritance. *M. lysimmia* appears to come closer to *elisa*, although Bates thought he had transitions to *polymnia*, and *M. macrinus* perhaps points more nearly to *lycidice*; *franis* and *mantineus* represent each other, and the specimen described below is perhaps an intermediate.

SUMMARY OF FORMS HERE RECOGNIZED AS SPECIES.

(Aberrant specimens are not allowed for in this table)

- A. Separate or nearly separate black postmedial bars on  $M_8$  and  $Cu_1$ ; R and  $M_1$  of hind wing closely approximate in male (stalked in female?).
  - B. Two costal spots on hind wing.....**equicola**
  - BB. Without two costal spots on hind wing.
    - C. Border of hind wing linear.....**truncata**
    - CC. Border of hind wing of large black triangles containing white spots ..... **proceris**
  - AA. A black comma mark in cell  $M_3$ , or the cell filled with black; R and  $M_1$  of hind wing in male widely separated, in female not stalked.
    - B. Postmedial pale spot in cell  $M_1$  of fore wing transverse, frequently absent.
      - C. Base of cell  $Cu_1$  heavily black.....**elisa**
      - CC. Base of cell  $Cu_1$  of the pale ground color.....**lysimmia**
    - BB. Postmedial pale spot in cell  $M_1$  longitudinal, rarely if ever absent.
      - C. Smaller, with somewhat translucent wings; red submarginal stripe of hind wing narrow and of almost even width.
      - D. Ground normally yellow and heavily marked with black.. **mantineus**
      - DD. Ground tawny at least over median area and more lightly marked with black toward base.....**franis**
    - CC. Larger with opaque wings, median black band straighter, leaving a subterminal tawny area which is widest at the middle.
    - D. Medial pale area and postmedial markings broadly connected.
    - E. Black spot at lower angle of cell smaller than the one at upper .....**polymnia**

- EE.* Black spot at lower angle of cell larger than the one at upper; base of wings frequently black....**mazzæus**
- DD.* Postmedial band separated by black markings from the medial tawny area; lower spot at end of cell when recognizable larger than upper.
- E.* Yellow postmedial spot in cell  $M_1$  widely separated from the radial vein; black spot in base of cell  $Cu_1$  small or absent .....**macrinus**
- EE.* Postmedial spot in cell  $M_1$  resting on the vein, and in contact with the postmedial costal spot; a large black triangle in base of cell  $Cu_1$ .
- F.* End of comma-mark connected to inner margin, cutting off a tawny anal spot from the yellow postmedial area .....**lycidice**
- FF.* Ground color in cell  $Cu_2$  continuous to anal angle, and without a sharp change in color.
- G.* Outer end of postmedial yellow bar occupying the center of cell  $M_3$  .....**doryssus**
- GG.* Outer end of postmedial yellow bar occupying the lower part of cell  $M_3$ ....**eurydice**

#### Key to Forms

1. Hind wing with two large black subcostal spots, at middle and end of cell, sometimes obscure above in male (*equicola*).....2
1. Hind wing without two separate costal spots.....3
2. Hind wing with two separate series of spots on the disc.....  
\***e. equicoloides**
2. Discal and marginal bands partly fused into a patch.....  
**equicola (sylvanoides)**
3. Fore wing with a black streak centering on outer part of  $Cu_1$ , sometimes partly fused with a similar shorter streak on  $Cu_2$ , forming a sort of comma-mark, which crosses both veins broadly....4
3. Fore wing without streaks centering on  $M_3$  and  $Cu_1$ , the space between these veins commonly filled with black, or with a comma-mark completely enclosed between these veins, female with R and  $M_1$  not stalked:.....7
4. Under side with conspicuous white marginal spots in black triangles on both wings; fore wing with only one rounded spot in middle of cell, and a faint dark shade toward base; upper side of fore wing largely yellow.....\***proceris**
4. Under side with a linear black border, not containing white spots on hind wing; fore wing with a triangular spot in base of cell as

\*Species marked with an asterisk are in the collection of Cornell University or my own collection.

- well as the spot at the middle, at least on under side; upper side usually with only a yellow postmedial band; female with R and  $M_1$  stalked (*truncata*) .....5
5. Fore wing with a yellow postmedial fascia.....6
5. Fore wing with a yellow discal spot only.....t. *olivencia*
5. Ground of fore wing wholly brown or tawny.....\*t. *huallaga*
6. Ground of fore wing deep red-brown, with heavy black markings .....\*t. *truncata*
6. Ground tawny, with light black markings.....\*t. *juntana*
7. Fore wing with the tawny or yellow postmedial fascia broadly connected with the tawny base.....8
7. Fore wing with postmedial light band or spots completely separated from the reddish (or yellow) base by a black fascia (sometimes with a yellow median band across the cell, or with the apex wholly black) .....19
8. Hind wing normally with a narrow median band; fore wing with upper spot at end of cell larger than lower, or with the band at end of cell broader at costa.....9
8. Hind wing almost always with a very broad median band, often fused with the black border; fore wing almost always with lower spot at end of cell larger than upper, or with a bar broader at the lower end (*mazaesus*).....13
9. Fore wing typically with two separate spots at end of cell; black spot in base of cell  $M_3$  very small, much wider than long (*polymnia*) .....10
9. Fore wing with a single bar across end of cell; spot in base of cell  $M_3$  much longer than wide.....\*doryssus (light specimens)
10. Under side of hind wing in both sexes, and upper side in female without a black postmedial band, the band above very broad in the male; postmedial yellow band of fore wing much narrowed toward inner margin (Ecuador).....\*p. *chimborazona*
10. Hind wing with black medial band about alike in both sexes and as strong below as above; yellow band of fore wing about as broad at outer margin as near end of cell.....11
11. Ground dark red-brown, the apical streak very strong and contrasting; spot in cell normally triangular.....\*p. *caucaensis*
11. Ground tawny; subapical spot smaller, spot in cell rarely triangular .....12
12. Subapical streak distinct, at least below; hind wing without yellow fascia .....\*p. *polymnia*
12. Subapical streak absent; hind wing with a yellow stripe in cell .....\*p. *casabranca*
13. Fore wing with ground tawny to base, at least in cell.....14
13. Fore wing with base solidly black, or at most with slight red-brown streaks; hind wing all black except apex.....17

14. Hind wing with separate black postmedial and margin bands....15
14. Hind wing black, with a red stripe in cell and apical patch only .....16
15. Fore wing with apex solid black.....\**m. nigroapicalis*
15. Fore wing with a narrow and sharply defined red-brown band in apex .....\**m. mazæus*
15. Fore wing with a larger diffuse tawny subapical area, more or less shaded with yellow, and sometimes connecting below with the tawny median area, which also has some yellow scaling.....  
\**m. jurimaguënsis*
15. Apical portion of fore wing suffused with red-brown.....  
*m. phasianita*
15. Fore wing with postmedial band yellow and apical region marked with yellow .....†*m. lucifera*
16. Fore wing with apex solid black .....†*m. pannifera*
16. A yellow spot in apical region..... †*m. fallax* (?)
17. Two yellow submarginal spots, in cells  $M_3$  and  $Cu_1$  of fore wing .....*m. meterus*†
17. Outer margin without pale spots.....18
18. Fore wing with a yellow postmedial fascia.....†*m. messenoides*
18. Fore wing all black and red.....\**m. deceptus*
19. Fore wing light yellow along base of  $Cu$ , with red showing as a spot at anal angle only; hind wing with a narrow red submarginal band .....\**mantineus*
19. Fore wing with base deep ochre or darker, the base of  $Cu$  not paler than the region at the anal angle.....20
20. Fore wing as a rule with a zigzag postmedial fascia, in any case with the yellow postmedial area in cell  $M_1$  a longitudinal oblong, and that in  $M_2$ , when present, much shorter and transverse; antenna mostly yellow .....21
20. Fore wing with an obliquely transverse pale postmedial fascia in cell  $M_1$ , frequently continuous with a similar one in cell  $M_2$ , or else wholly black postmedially, never with a zigzag postmedial fascia .....33
21. Spot in cell  $M_1$  small, widely separate from the costal postmedial spot when that is present, and well separated from the stem of  $R$ ; no postmedial yellow spot in cell  $M_2$ .....\**macrinus*
21. Spot in cell  $M_1$  in contact with that on the costa, being separated only by the black vein, almost always with a transverse spot in cell  $M_2$  also .....22

‡I have entered this species where it would run in the key. I very much doubt if it is a *Mechanitis*.

†Species marked with a dagger have been examined in American collections.



22. A small rounded black spot in base of cell  $Cu_1$  or none; hind wing with broad and subequal postmedial and marginal black bands, with a narrow and even red stripe between them, or with outer part of wing wholly black (*franis*).....23
22. A large triangular black area in base of cell  $Cu_1$ , usually leaving a squarish yellow or more rarely reddish spot in the middle of that cell; hind wing normally with black border slender, preceded by a reddish area which is broadest at the middle.....24
23. Hind wing with separate discal and marginal black bands.\*f. *franis*
23. Hind wing with outer half solid black.....\*f. *menapis*
24. Marginal and postmedial light areas in cell  $Cu_2$  separated by a complete black bar, extending down from the comma-mark or from the black filling of the outer part of cell  $Cu_1$  to the black inner margin, rarely with vein  $Cu_2$  narrowly red; border of hind wing even and commonly linear, in the male a third as wide as the discal band, which is often obsolete in the female; antenna mainly black (*lycidice*) .....25
24. Marginal and submarginal spots in cell  $Cu_2$  broadly connected, normally both tawny; comma-mark distinct, connected to the black postmedial band but not to the inner margin; median fascia on hind wing about as broad as the black margin and alike in both sexes, the border often of white-centered black triangles.....27
25. Ground darker; postmedial band broken into spots; band below lower angle of cell often of two separate spots, or with the lower spot (below  $Cu_2$ ) lost; band of hind wing of male commonly entering cell; female with apical region of fore wing two-thirds black, and a third or less yellow.....\*l. *isthmia*
25. Ground paler; postmedial band of both sexes complete; spot at lower angle of cell large, complete, crossing  $Cu_2$ ; band of hind wing not entering cell; female with apical half of fore wing nearly half yellow .....\*l. *lycidice*, 26
26. Cell of hind wing of male with a little yellow, of female all tawny .....typical form
26. Cell of male wholly yellow, of female with considerable yellow....  
form *arcana*
27. Male antenna with only apical third yellow; fore wing beneath with outer end of the yellow postmedial band pointing directly at the white terminal spot, or bifurcated and almost enclosing it; inner edge of black bar at end of cell waved. Fascia on middle of hind wing above slightly widened in male only....\*doryssus *veritabilis*
27. Male antenna mainly yellow, with basal third black.....28
28. Outer end of yellow postmedial band beneath pointing directly toward the white marginal spot, or bifurcate and almost enclosing it, when narrowed occupying upper part of cell; inner edge of the bar at end of cell oblique and nearly straight, border of hind wing

- normally nearly even. Male with fore wing less than four-tenths as wide as long (*doryssus*).....29
28. Outer end of postmedial band pointing decidedly below the white marginal spot, the band when narrow occupying the lower part of the cell; inner margin of cell-bar irregular or sinuous. Male with fore wing more than four-tenths as wide as long (*eurydice*)....32
29. Ground deep ochre yellow, only apex of black discal band of hind wing preserved ..... ♀ form \**labotas*
29. Median band of hind wing practically complete.....30
30. Median band interrupted at the middle (Honduras).....d. *utenãia*
30. Median band complete, continuous (Guatemala to Costa Rica)..31
31. Postmedial yellow band of fore wing very narrow, normally less than half as wide as the dark ones before and beyond it; ground dark tawny .....\*d. *saturata*
31. Postmedial band and light markings generally, broader; ground lighter tawny .....\*d. *doryssus*
32. Fore wing with the pale spot in middle of cell  $Cu_1$  yellow; hind wing with a strong yellow band in cell of male, and with some yellow in female.....\*e. *eurydice*
32. Fore wing with the quadrate light area in middle of cell  $Cu_1$  largely or wholly tawny; hind wing without any yellow; ground darker brick red .....\*e. *doryssides*
33. Base of cell  $Cu_1$  of fore wing wholly yellow or rarely with a small black dot; subapical pale spot broad and rounded (*lysinnia*)....34
33. A large triangular black patch filling the base of cell  $Cu_1$  of fore wing, or cell  $Cu_1$  mostly black with a yellow spot only (*elisa*)..37
34. Subapical spot yellow .....35
34. Subapical spot white .....36
35. With postmedial yellow dots at costa and inner margin..\*l. *nessæa*
35. No postmedial spots .....l. *sulphurescens*
36. Under side with a second irregular white submarginal spot below the subapical spot, the lower half of it showing on the upper surface also .....\*l. *albescens*
36. No such spot; the subapical spot occasionally edged on the inner side with a complete white band..... l. *lysinnia*
37. Fore wing with spot in cell  $Cu_1$  overflowing into cell  $Cu_2$ ; typically with an oblong postmedial band or bar between the costal and dorsal spots; and cell-spot crossing R.....\*e. *ocona*, 38
37. Yellow spot in cell  $Cu_1$  crescentic or rounded, not crossing  $Cu_2$ , cell-spot not crossing R; postmedial spots at costa and at inner margin only .....\*e. *elisa*
38. Yellow spots small, the one in cell  $Cu_1$  accompanied by a separate satellite below  $Cu_2$ ; hind wing without a median band above, with separate spots below .....ab. \**menecles*
38. Yellow spots large, and spots in cells  $Cu_1$  and  $Cu_2$  broadly continuous; hind wing with a postmedial band.....\*typical form

## NOTES

*M. equicola* (Cr.) Cramer's original figure of *Papilio equicola* shows plainly the single white marginal spots of a *Mechanitis*, not the double spots of a *Melinæa*, and also the characteristic broad zigzag yellow postmedial band and the two costal spots on the hind wing, of *equicoloides*. The postmedial and marginal black areas are almost completely fused on the hind wing, and so *sylvanoides* Godman and Salvin becomes a synonym. *Equicoloides* is a variant form, but perhaps worth a name. The male genitalia are characteristic, lacking the emargination at the apex of the valve, which is well-marked in *truncata* as well as the remaining species.

*M. truncata* Btl. This is also a well-marked species, both on pattern and genitalic characters. The truncation of the hind wing cited as the best specific character is confined to the male, and is difficult to appreciate, as in the typical group the hind wing is only a little less truncate. A better character may exist in the venation: in the female of *M. truncata* R and  $M_1$  of the hind wing are strongly stalked, and in the male they are approximate at the origin and strongly curved; in the females of the *polymnia* group R and  $M_1$  are separate or barely stalked while in the male they are well separated and only moderately curved. Males of *M. equicola* and *M. proceris* agree with *truncata*, but I have not seen females. In *truncata* also  $M_1$  is stalked in the fore wing almost out to the origin of  $R_2$  from the radial stem, in the *polymnia* group, it frequently is free, but the amount of variation is extraordinary. *M. truncata* differs from all the other species, apparently even from *M. proceris*, in the presence of two well-marked black spots in the cell of the fore wing, at least on the under side. The more basal one is triangular, the outer, which represents the spot present in other species, nearly round. The *polymnia* group are also separable by the black postmedial mark in cell  $M_1$  being confined between the veins, unless the whole outer part of the wing is black, while in the other three species there are two separate or partially separate black bars centering on the veins. The species breaks into forms parallel to those of the *polymnia* group and easily confused with them. For instance

*egaënsis* Bates is a form of the *polymnia* group, while his var. B is typical *truncata*. I have received a dark specimen of form *juntana* as *fallax*, but the original description shows that name belongs in the *polymnia* group, and I have placed it doubtfully in the key.

The male genitalia are close to those of *polymnia*, but the gnathos is simple at its junction with the tegumen, and the valves are shorter and broader, with a heavier spur at their tips.

In some of the specimens of *M. t. juntana* in the Carnegie Museum the yellow is extended, almost as in *M. proceris*, but the hind wing pattern is distinctive, one aberration has the yellow replaced with gray.

*M. proceris* Weymer. This appears to be a good species, with the truncation of the hind wing even more exaggerated than in *M. truncata*. There is a similar form of *truncata* with an extended yellow area on the disc of the fore wing, but the lightly marked hind wing will easily separate it.

*M. polymnia* (L.). This is the oldest species of the genus, and typical of a large group of forms, which I have treated as six species, though I think there are fewer. For instance, there are specimens intermediate between *caucaënsis* and *veritabilis* in the Carnegie Museum, and others which resemble *veritabilis* save in the yellow antenna, from Venezuela. Bates also speaks of material from Central Brazil connecting *polymnia* with *nessæa*, though I have seen none. *Eurydice* and *doryssus* should perhaps be united even on present knowledge, as they seem to intergrade in Colombia, but *mazæus* also seems to intergrade with *polymnia*, and *mazæus* and *eurydice* certainly appear distinct.

Forms *polymnia*, *casabranca* and *caucaënsis* can hardly be kept separate even as varieties, as they fly together in most places to a greater or less extent, and the best one can say is that a given locality belongs predominantly to one or the other. I would credit typical *polymnia* to the Amazon basin as well as the Guianas.

*M. mazæus* Hew. The only form that I have taken in numbers is *M. m. deceptus*. I suspect that after all this may be a Mendelian form of *eurydice*, in spite of the striking difference in coloring due to mimicry of *Heliconius*. In light specimens (typical

*masæus*) the arrangement of the spots is exactly as in *eurydice*, and they may possibly be hybrids. As things now stand it is best to keep the names separate.

**M. eurydice** Stgr. Hænsch associates this form with *lycidice* and *isthmia*, an obvious mistake, as it is the southern representative of *doryssus*, differing only in a small point of pattern. I have kept the name distinct, but have seen intermediates from Colombia. The form appears very rare in American collections, but was abundant in the Chanchamayo district, flying with the closely similar *Hirsutis neitha* in many cases, but tending a little more to keep in the shade.

**M. jurimaguensis** Stgr. This species when described was compared with *truncata*. A specimen received from Staudinger and Bang-Haas, is however a light form of the *masæus* type and rather close to typical *masæus*. It may be misdetermined, but the original description is inadequate, and the broad black bands on the hind wing mentioned in the description certainly do not point to a *truncata* form. The female of this form was sent to me as *metera* Hew. This is obviously incorrect, as *meterus* has quite a different wing-form according to the original figure, as well as pale marginal spots. I am almost certain that *meterus* is a *Ceratinia*, and probably a variety of *mansuetus* mimicking the same *Heliconius* group as *M. masæus deceptus* and *Hyposcada fallax*.

**M. macrinus** Hew. This form is very close to the *polymnia* series on one side and to *lycidice* on the other. I suspect it is a form of *lycidice*, but as the distributions overlap I keep it separate. I have received a specimen with the yellow median area almost replaced by tawny, determined as *labotas*.

**M. lycidice** Bts. This form keeps perfectly distinct from the *doryssus* forms occupying the same areas, and is certainly as good a "species" as any in this series. I cannot see how Hænsch mixed it with *eurydice*. The various forms intergrade perfectly and each is highly variable, so that frequently a given specimen could be called by one varietal name as well as another. I have no data on *M. californica*. It is commonly credited to *M. l. isthmia*, which is the species Holland figures to represent the name.

*M. mantineus* Hew. This is in appearance the most striking perhaps of all the *Mechanitis*es, but in detail of pattern is not unlike the darker forms of the *polymnia* group. The translucency and the arrangement of the pattern on the hind wing point to a connection with *franís*, and the following form, represented by a single specimen in the U. S. National Museum, is possibly an intermediate. As I should analyse the pattern it leans rather toward *mantineus* than *franís*.

Antennæ yellow. Ground tawny; fore wing with yellow postmedial fascia very broad, the yellow area in cell  $M_3$  being three times as long as broad, and the rest in proportion, completely cut off from the tawny base. Hind wing with a broad black border with two extensions inward in each interspace (unlike all the other *Mechanitis*-forms); postmedian fascia running well beyond cell and leaving a narrow red stripe of even width between itself and the border, much as in normal *mantineus* and *franís*. Under side with large white marginal spots.

*M. franís* Reak. The translucent wings as well as the shape of the bands of the hind wing of the typical form connect this species with *M. mantineus*.

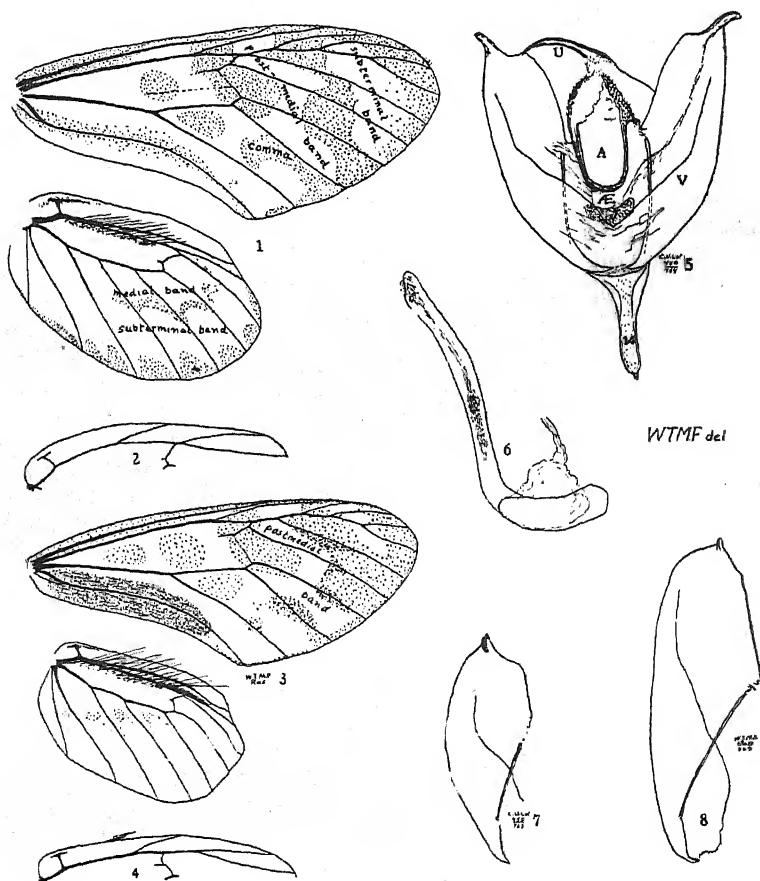
*M. elisa* Guer. This group of forms certainly seem to represent a species distinct from the *polymnia* series, flying together with *eurydice* in Central Peru. I have no specimens as light as Hænsch's figure of *M. ocona*, but have seen one in the Carnegie Museum from eastern Bolivia; Peruvian specimens certainly represent this form; *menecles* seems to be merely a name for dark specimens, and hardly worth distinguishing. I follow general usage in applying the name *elisa* to the southern race which I have from the provinces of Tucuman and Jujuy, Argentina.

*M. lysimnia* F. At first sight this species seems to represent *macrinus* in the south, but some specimens show plainly the postmedial band as an irregular series of white spots on the under side. In these specimens the spot in cell  $M_1$  is clearly transverse, connecting the species with *elisa* rather than the *polymnia* group, as Bates imagined. I have seen nothing that by any stretch of imagination could be called an intermediate.

## EXPLANATION OF PLATE XII.

1. *Mechanitis doryssus*, transitional to *polymnia*. Venation and pattern of male.
2. *M. eurydice*. Costa of hind wing of female.
3. *M. truncata huallaga*. Venation and pattern of male.
4. *M. truncata*. Costa of hind wing of female.
5. *M. eurydice*. Male genitalia.
 

U.	Uncus
V.	Valve
Vi.	Vinculum
6. A. Position of anal tube.
7. J. Juxta
8. Aedæagus of *M. eurydice*.
9. Left valve of *M. truncata jantana*.
10. Left valve of *M. equicola equicoloides*.



## PROCEEDINGS OF THE NEW YORK ENTOMOLOGICAL SOCIETY

MEETING OF OCTOBER 16, 1923

A regular meeting of the New York Entomological Society was held at 8 P. M. on October 16, 1923, in the American Museum of Natural History. President Harry B. Weiss in the chair with 15 members and five visitors present.

Mr. H. H. Rucker, of College of City of New York,

Dr. Roland F. Hussey, New York University,

Dr. Priscilla Butler Hussey, 32 Waverly Place, N. Y. City,  
were elected members of the Society.

Mr. Davis read a paper on "The Orthoptera of Wingina, Virginia, which will later be printed in full. It was discussed by Mr. Olsen, Mr. Weiss, and Mr. J. C. Bridwell, lately of Hawaii.

Mr. Loren B. Smith, of the Japanese Beetle Laboratory at Riverton, N. J., read a paper on *Popillio japonica* which since it was first found by Weiss & Dickerson at Riverton, has spread over an area of from 3500 to 4000 square miles, though its distribution is still irregular. In one peach orchard 15 washtubs full were obtained but elsewhere far less. The life history of the beetle was described including its omnivorous appetite which includes 218 kinds of plants. The remedies and attempts to control it by parasites and bacteriological diseases were also discussed. The cost of the control measures was stated to be \$170,000.

MEETING OF NOVEMBER 6, 1923.

A regular meeting of the New York Entomological Society was held at 8 P. M. on November 6, 1923, in the American Museum of Natural History. President Harry B. Weiss in the chair with 12 members and five visitors present.

The thanks of the Society were voted to Mr. Davis for his generous donation towards the cost of printing the "Journal".

The President announced the death on October 30 of Mr. Edgar L. Dickerson. Mr. Dickerson died at the Passaic Hospital, following an operation, and was buried at Chester, New Jersey, where he was born January 13, 1878. He had been a member of the Society for more than ten years and regular in his attendance at its meetings, to which he frequently contributed matters of interest.

On motion by Mr. Davis, resolutions of sympathy were ordered to be prepared by a committee to be appointed by the President.

In view of a further increase in the cost of printing the "Journal", the publication committee was requested to submit a report at the meeting of December 4.



Dr. Sturtevant and Mr. H. H. Johnson spoke on "Associations between Flies of the sub-family *Borborinae* and Dung Beetles of the family *Scarabaeidae*", illustrated by specimens of both. The following abstract has been prepared by Mr. Johnson:

The Dipterous sub-family *Copromyzinae* (*Borborinae*) includes the genera *Sphaerocera*, *Leptocera*, and *Copromyza* (*Borborus*), all of them typical dung feeders. *Trichocypsela*, one of the numerous subgenera of *Leptocera*, contains four Old World species (Spain, Africa, Ceylon) that are always to be found on the ventral surfaces of *Scarabaeus* and other related dung-beetles. *Trichocypsela* has not been found in America, but we have found similar habits in an undescribed species of a common subgenus (*Borborillus*) of *Copromyza*. This species was observed upon the elytra of dung-beetles rather than upon the ventral surface, and specimens were obtained upon *Phaneus carnifex* on Nonamasset Island, Mass., and upon *P. igneus* and *Canthon lacvis* at Crescent, Ga. Like *Trichocypsela* these flies, conspicuous by their dark bodies and snowy white wings, are apparently not parasites, but probably use the beetle only for transportation ("phoresic species"). Unlike *Trichocypsela* they were found relatively common upon the dung itself even when no beetles of the species affected by them were found to be near. *Copris* and smaller species of *Canthon* were not ridden by the fly; and other *Copromyzines* were not observed to ride beetles.

Mr. Johnson also exhibited specimens of *Drosophila inversa* Walker, taken at Macon, Georgia. The species has previously been recorded from New Jersey, Indiana, Illinois and northward. Mr. Johnson's observations indicate that the larvæ are true parasites on the alder spittle-insect. Other apparently new records for Georgia are *Zacompsia fulva* Coquillett, *Drosophila hydei* Sturtevant, *D. mulleri* Sturtevant, and *D. signoides* Loew. An apparently undescribed species of *Canace* (*Ephydrinae*) was found in enormous numbers on *Spartina* grass in salt marshes at Crescent, Ga., where it is locally known as marsh-gnat. This genus is not listed in Aldrich's "Catalogue"; and, while Williston lists it in his "Manual of North American Diptera", a more definite record as to species or locality was not found. A different species of the same genus has been taken by Dr. Sturtevant in Massachusetts.

Mr. Notman spoke on "Collecting Beetles on a Transcontinental Automobile Tour" with illustrations by about 100 photographs and a part of the beetles he had collected. Leaving New York May 2 he had returned to Keene Valley, N. Y., September 23, making fourteen stops of from 1 to 14 days duration, visiting four national parks, and collecting over 10,000 beetles. The stops were made in Michigan, Minnesota, North Dakota, Montana, Idaho, Washington, Utah, Oregon, and Yellowstone Park, whence he drove homeward for three weeks without stops for collecting.

Mr. Notman described each of the places at which he had stopped and mentioned some of the interesting species he had found particularly in the

families *Carabidae* and *Staphylinidae*. He said that in collecting beetles along the river front he had observed no striking differences in the fauna but that the forests west of the Rocky Mountains, presented a different appearance from the preponderance of evergreens.

His remarks were discussed by many of the members, developing that Mr. Notman had captured as well as beetles, cicadas, butterflies, membracids and other insects of interest; and had devoted a part of his time to painting some of the striking scenes in the national parks.

Mr. Davis announced the death at St. Petersburg, Florida, about October 25, of George Franck, long an honored member of the Brooklyn Entomological Society, which formerly met at his home. Mr. Franck had reached an advanced age.

Mr. Davis also showed a newspaper clipping received from Warren Knaus regarding a poisonous spider in Kansas.

#### MEETING OF NOVEMBER 20, 1923

A regular meeting of the New York Entomological Society was held at 8 P. M. on November 20, 1923, in the American Museum of Natural History. President Harry B. Weiss in the chair with 19 members and seven visitors present.

The following resolutions were adopted:

WHEREAS the New York Entomological Society has learned with deep regret of the untimely death of its member, Mr. Edgar L. Dickerson, therefore be it

RESOLVED that this Society records with deepest regret the loss of one of its most enthusiastic and respected members.

RESOLVED that the members of this Society tender to the family of its late member, an expression of sympathy in their loss and express the hope that the memory of his many virtues will afford consolation in their grief.

RESOLVED that these resolutions be entered on our minutes and a copy forwarded to the family of our late member.

The president read the obituary notice he had prepared for "Entomological News".

Dr. O. A. Johannsen, of Cornell University, was elected a member of the Society.

The Secretary read communications in relation to "Zoological Record" from Dr. E. W. Gudger. On motion by Mr. Davis, subscription by the Society to 10 copies of the *Insecta* portion was authorized for its members.

The Secretary exhibited a separate from *Zoologischen Jahrbuchern*, bd., 47, 1923, containing descriptions by Dr. Walther Horn of *Cicindelidae* with reference to North American species, also at the request of Mr. Mutchler, 112, A Memoria del Directorio Compania Administradora del Guano, Lima, 1921, containing description by Dr. Robert C. Murphy of

*Psammotrichus lavallei*, a new species of Coleoptera from the Guano Islands of Peru, the type of which is in the Brooklyn Museum, also Circular No. 80, Exp. Sta., Porto Rico, being a popular account of El Cucubano.

Mr. Davis exhibited and highly praised Bulletin 36, New Jersey Agricultural Department, Graphic Summary of N. J. Agriculture by Harry B. Weiss.

Dr. Hussey gave a learned "Discussion of Development of Mouth Parts in *Belostoma*", illustrated by lantern slides. After a review of the literature of the subject he showed how in June and July it was possible to obtain plenty of eggs from the back of the male and then trace their development. This Mrs. Hussey and he had done after obtaining about 150 eggs from each of 40 males. The stages of development were shown on the screen from drawings made until the lymph appeared and demonstrated the formation of the four-pointed beak.

Dr. Hussey's paper was discussed by Messrs. Weiss, Notman and Leonard, especially in reference to the dilution of food by injection of saliva of Hemiptera and the consequent effect upon the plants attacked.

Messrs. West and Weiss spoke of "The Plants and Insects of a Dry Woods in the Pine Barrens of New Jersey", illustrated by about 20 boxes of the insects found, topographical map of N. J. and a tabulated chart of the results.

Mr. West first described the area selected, about 20 acres, 14 of forest and 6 of open ground, near Lakehurst, N. J., and the trees, shrubs and herbaceous plants found growing there in a sandy soil, entirely destitute of water courses. Mr. Weiss then showed how carefully the insects had been collected on repeated visits at different seasons and by various methods, sifting, sweeping, beating, and netting, until they were satisfied that a fair sample had been obtained. Final conclusions were reserved until a similar survey of other areas was completed.

Dr. Leonard gave a brief report on the progress made on the New York State List of Insects, to the effect that fifty specialists have volunteered and that the sheets are in progress.

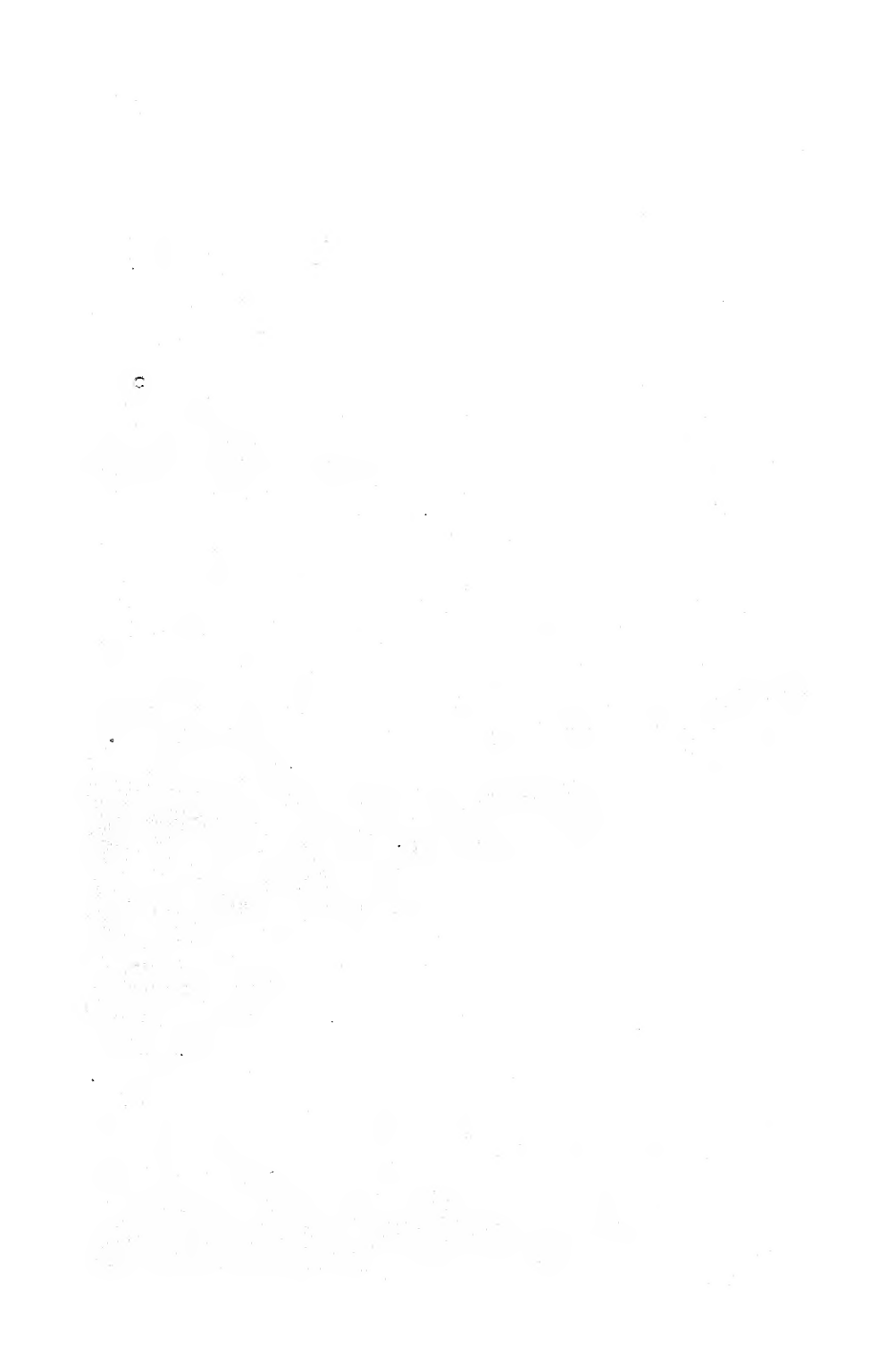
## THE COLORS OF BUGS

Two papers by Leroy S. Palmer and Harry H. Knight on the colors of bugs have recently appeared in the "Journal of Biological Chemistry" (Vol. LIX, No. 2, March, 1924, pp. 443-449; pp. 451-455). These authors, after a chemical study, conclude that "the yellow and red colors seen in the hypodermis of the stink-bug, *Perillus bioculatus* (Fab.), are due largely to carotin which is derived from the food; namely, chiefly the lymph of the potato beetle, *Leptinotarsa decemlineata* (Say)," and state that the lymph of the potato beetle is colored entirely by carotin, the concentration in fresh lymph being as high as that found in fresh green leaves. Carotin has been defined as a ruby red crystalline substance found in the chromoplasts in various plants especially the carrot.

The authors made chemical examinations of the red pigment in other bugs and found that it was not limited to one type of substance but that "water soluble pigments appear to be more common than carotin." They report that the vermilion color of the aphid *Tritogenaphis rudbeckiae* (Fitch) is due chiefly to an anthocyanin-like pigment although small amounts of carotin are present. Anthocyanin is a coloring matter found in the cell sap of many plants and is red in the presence of acids. The red color of the red and black plant-bugs *Leptocoris trivittatus* Say, *Lygæus kalmii* Stal, *Lopidea staphyleae* Kngt., *Coccobaphes sanguinarius* Uhler and the assassin-bug *Eulyes illustris* Stal was found to be due to a flavone-like pigment. Flavone is the parent substance of a large number of yellow dyestuffs.

Palmer and Knight state that it is difficult to "understand how environment can cause a permanent modification of an insect color pattern involving an animal pigment which is derived from the food, and which is subject to fundamental physiological processes of the protoplasm without first causing a permanent modification of the processes to which the derived pigment is subject" and believe that the claim that red pigment in insects can be so changed and the changes become inheritable loses weight in view of the findings that the pigment is likely to be one of the previously mentioned substances derived from the food.

H. B. WEISS.



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### GUSTAV BEYER.

Gustav Beyer, for many years a member of the New York Entomological Society, died on August 23 at his home, 310 Summit Avenue, Mt. Vernon, N. Y. Mr. Beyer was born July 5, 1840, in Wolkenstein, Saxony, and was educated from early youth in the manufacture of furs. He acquired a competence as a manufacturing furrier in New York City and, when he was past forty years of age, began to make a collection of beetles. The late George Franck, who was at the time one of his salesmen, introduced him to the pursuit of insects. For more than twenty-five years he collected with an energy that soon made him the possessor of a remarkable collection. Long trips to the mountains of North Carolina, to the Florida Keys, to Texas, Montana, Arizona, and Lower California, where he remained for nine months, added to his collection long series of species that were new or rare in other collections. During these years his home at 511 East 117th Street was the scene of many entomological gatherings and the hospitality that he and Mrs. Beyer dispensed was unbounded. Coleopterists from far and wide came to know the back parlor with its cabinet drawers filled with duplicates, liberally donated to visitors, the little garden with its collection of cactus, and the basement dining room where good things to eat and coffee were provided, even at three o'clock in the morning. About ten years ago the infirmities of age checked his ardor for a time, but the removal to Mt. Vernon in 1917 proved beneficial and the opportunity of obtaining a large collection of Buprestidæ, accumulated by a German collector, renewed his interest. At eighty years of age he was working daily on this collection; and

until Decoration Day of this year he was able to move about the house and on his eighty-fourth birthday to receive fifty-eight visitors.

Mr. Beyer possessed a remarkably hardy constitution, which enabled him to withstand fatigue, thirst, and the roughest conditions on his collecting trips; and a persistence which kept him going, regardless of obstacles, when rare beetles were to be had. Many new species and one new genus which he had thus discovered were named in his honor. He was a keen lover of nature, as shown by his love of flowers as well as beetles. Above all, he was a wise and kindly man whose passing away will be most lamented by those who knew him best, his own family and the few entomologists of the last century, who still survive.

CHAS. W. LENG.

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### THE OLFACTORY SENSE OF THE CABBAGE BUTTERFLY.

Mr. Dwight Elmer Minnich, writing in the "Journal of Experimental Zoölogy" (vol. 39, No. 2, pp. 339-356), records the results of his experimental studies with *Pieris rapæ* Linn., and concludes that the antennæ "probably constitute the most important olfactory area, each antennæ being richly equipped with olfactory organs." Mr. Minnich describes his materials and methods in detail. Selecting the extension of the proboscis as the olfactory reaction, he found that when one antenna was eliminated from possible olfactory stimulation by being coated with vaseline or a paraffin-vaseline mixture or by amputation, the olfactory response was reduced very greatly, on the average 58 per cent. Mr. Minnich states that "there were no fundamental changes apparent in the general behavior" of the specimens following the coating of the antennæ and amputations and believes that the decreases of response were due chiefly to the elimination of the olfactory organs and not to an abnormal state of behavior.

ED.

## THE MALE GENITALIA OF CUPES CONCOLOR WESTW. (COLEOPTERA).

BY F. MUIR.

HONOLULU, T. H.

In the Transactions of the Entomological Society of London, Dr. David Sharp and the present writer described the male genitalia and last abdominal segments of *Cupes clathratus* Motsch\* (Japan). The material at our disposal was old and the membranous connections between the segments not at all intact. We described an unique structure which we marked f in our figures and considered it as an internal development of the ninth tergite. Thanks to the kindness of Dr. R. J. Tillyard, I have recently been able to examine a male of the American *Cupes concolor* Westw. and find that the above mentioned structure which we left unidentified is plainly the ninth sternite. Although there are small specific differences between the genitalia of the American and Japanese species, in all essential features they are similar, showing that a very close relationship exists between these two northern species. It is to be hoped that the male genitalia of the Australian species will shortly be described and figured.

To anyone familiar with the genitalia of Mecoptera, those of *Cupes* will suggest homologies. In *Cupes* the anus opens at the apex of a tube which shows no demarcation between tergite and sternite. This anal tube (figs. 1, 10) is evidently composed of the tenth and eleventh segments. At the base of the tube on the ventral aspect there is a pair of flat appendages (fig. 1 d) which suggest cerci. This is the only case in Coleoptera in which any organs suggesting cerci are found in the male. The ninth tergite is deeply bilobed, the lobes laying above and along side the anal tube. The ninth sternite projects caudad so that the ædægus is considerably enfolded by the ninth segment. A large membrane connects the ninth segments and the normally formed eighth. The tegmen of the ædægus is not differentiated into lateral lobes and

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(\*) Trans. Ent. Soc. Lond., 1912, III p. 522, Pl. LIX figures 103, 103-a; 104, 104-a, 104-b.

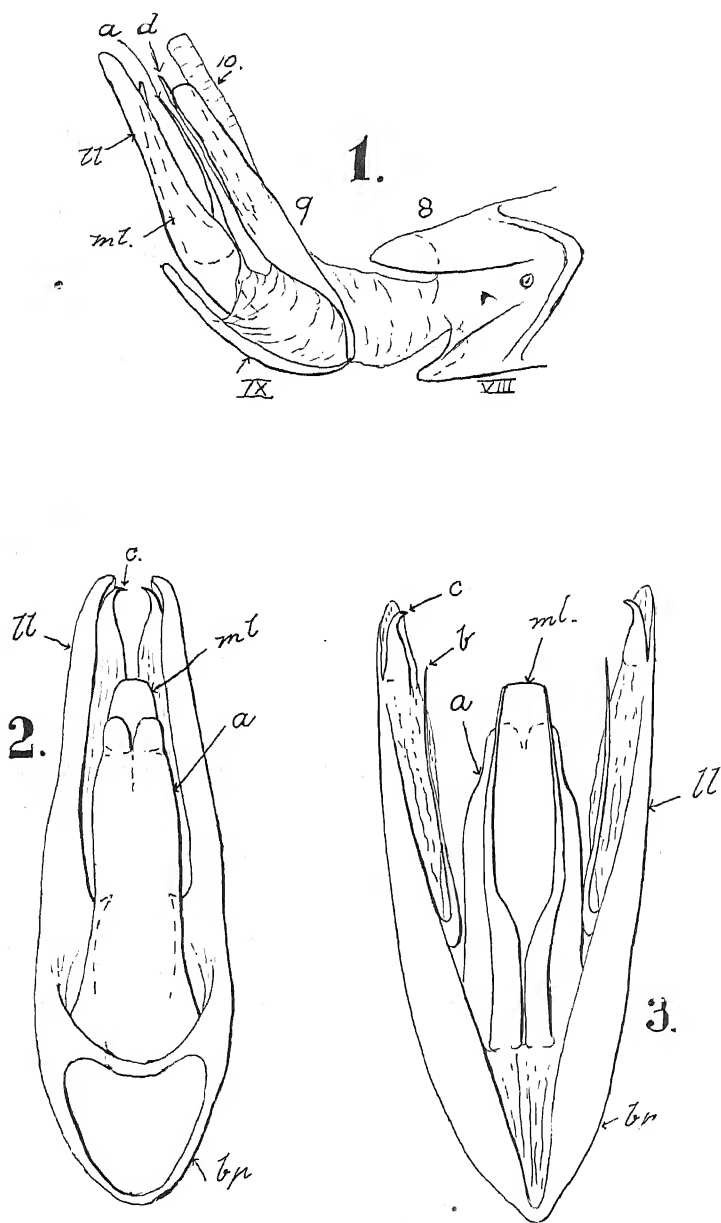


basal piece unless we regard the spine-like process (figs. 2 and 3, c) as the lateral lobes and the large plates on each side (figs. 2 and 3, ll) as development of the basal piece. Near the middle of the ventral edge of these plates marked ll arise a long, thin spine (fig. 3, b), another unique structure in Coleoptera as far as the writers knowledge extends. On the dorsal aspect and arising from the basal ring of the tegmen there is a long, narrow plate with a bilobed apex (figs. 2 and 3, a). This can be compared to a similarly situated plate in *Enarsus bakewelli*, *Dascillus cervinus* and *Atractocerus africanus*, and such a plate amalgamated to the median lobe would produce such a form as is found in *Lissomus bicolor*. The functional orifice of the median lobe extends from the apex to the base of the ventral aspect, the edges being brought near together at the base, so that the median lobe does not form a tube.

In the larvæ of *C. concolor* the ninth sternite is short and posterior to it there are two large oval processes with a minute process at the apex of each. These strongly suggest coxites and styles. Unfortunately the only pupa Dr. Tillyard possessed was a female, the imago of which could be seen within the pupal skin and the styles of the adult lay within the styles of the pupa. The cerci were also present in the pupa. A pupa of a male in the same stage of development might throw light upon the homologies of the male genitalia.

Although the genitalia of *Cupes* is more complex than is found in most other Coleoptera, I am inclined to consider it as a primitive form. The line of evolution of the genitalia in Coleoptera is from a complex form to a simple. In some forms (i. e. *Paropsis variolosa*) the tegmen is nearly suppressed and the median lobe, along with an internal sac, forms the functional organ; often the remaining portion reaches great complexity (i. e. *Xantholinus*). In other forms (i. e. *Prostenus dejeani*) the median lobe is nearly suppressed and the tegmen is the chief structure. It would be easy to compare the tegmen of *Cupes* with the outer portion of the genitalia of aculeate Hymenoptera which, although more complex, I consider as more primitive. In some of the parasitic Hymenoptera, which are evidently highly modified forms, the ædœagus





CUPES CONCOLOR.

is quite similar to the primitive Coleoptera, having a well developed basal piece, distinct lateral lobes and a tubular median lobe.

A complete study of the development of *Cupes* might throw light on the male genitalia of Coleoptera and other orders.

#### EXPLANATION OF PLATE XIII.

Fig. 1. Lateral view of last abdominal segments and genitalia of *Cupes concolor*.

Fig. 2. Dorsal view of ædœagus of *Cupes concolor*.

Fig. 3. Ventral view of ædœagus of *Cupes concolor*.

a. dorsal plate; b. spine on margin of lateral lobe; c. spine at apex of lateral lobe; d. cerci; bp. basal piece; ll. lateral lobes; ml. median lobes. 8, 9, tergites; VIII, IX, sternites; 10 anal segment.

## 1923 COLLECTING NOTES.

BY W. KNAUS,

McPHERSON, KANSAS.

The collecting season of 1923 in the Sand Hill country southwest of Medora, Reno County, Kansas, was one of the best in recent years. Weather conditions were especially favorable, the vegetation being abundant. Notably numerous in specimens was the large scarabæid, *Strategus mormon*, Burm., scores of examples being taken by students of McPherson College, a party of four from the State University at Lawrence, Kansas, and the writer, in May, June and the first week in July.

For the first time in a collecting experience of thirty-five years in this region, *Phyllophaga longitarsus* Lec. was taken and in abundance, at light, during the first and second weeks in July. During the day they burrow in the sand, and being almost indistinguishable in color, are never seen. They are also taken on the sand dunes of Smoky Hill river, near Manhattan, Kansas, at light.

A large scarabæid attracted by light the past season, near Medora, was *Polyphylla hammondi* Lec. Among thirty specimens coming to light the first week in July only five were females, and I have never taken a higher proportion of this sex.

The last week in June, 1902, I took at Englewood, Kansas, 175 miles southwest of Medora, numbers of a small light colored *Aphodius* which was described in 1905 by H. C. Fall, as *A. knausi*. I never took this species again until the first week in July last season when it was very abundant at light in the sand hills near Medora. No specimens were seen during the day.

In past years, occasional specimens of *Anomala ludoviciana* Schaeffer were picked up in the sand hills, but this past season during the last week in June, between 5 and 7 o'clock in the afternoon, this species was found in numbers on sand and on low vegetation, mating. They are sluggish in movement, and no net is required to take them. A form of *Anomala flavipennis*, *modulata* Casey, is taken at light, the first and second weeks in July.

The last of May and the first half of June, *Serica ochrosoma* Dawson is attracted to light but rarely in numbers; last season

only five were taken. They feed on cottonwood leaves during the early part of the evening.

*Bolbocerus fossatus* Say. was not very abundant, only a half dozen specimens being taken. They were mostly found in perpendicular holes, eight to twelve inches deep, in the sand, but two or three came to light.

*Cicindela lepida* Dej. was very abundant on bare sand "blow outs" and adjacent to pools of water in the "blow outs". It was very abundant the last part of June and the first half of July. The form *insomnis* Casey, with green head and thorax, occurred infrequently, not to exceed one to twenty of the ordinary form. *Lepida* is attracted to light and by carrying a gasoline lantern or using a flash light can be picked up on the bare sand.

*Cicindela hirticollis* Say. was abundant near pools of water in the "blow outs" in company with *lepida*. *Cicindela lengi* W. Horn. was more than usually common around sand dunes, the individuals taking shelter in the shade of vegetation to escape the heat of the sun. *Formosa* Say. also occurred in numbers, and is much more wary than *lengi*. The common *scutellaris* Say. was also abundant during May, June and the first part of July.

The milkweed cerambycid *Tetraopes canescens* Lec. was taken in numbers from mid-June to mid-July. Light, the first and second weeks in July, attracted several specimens of *Ochodæus kansanus* Fall.

On July 4th, four members of the Kansas University Entomological Summer Field Force, Kenneth Krehbiel and the writer visited Belvidere, Kiowa County, 150 miles southwest of McPherson, and collected on the evening of that day, July 5th, and until the afternoon of July 6th. On a salt marsh just north of Belvidere, *Cicindela circumpecta* Laf., *Cicindela* var. *globicollis* Casey, *Cicindela macra* Lec. *Cicindela knausi* Leng. and two or three specimens of *Cicindela fulgida* Lec. were taken. The first three were abundant on the salt encrusted flats, while *knausi* occurred on damp mud near water. The *circumpecta* were of the brown, green and rarely the blue form. On thistle heads several *Trichotima texanus* Horn were taken.

In a small rock cave a mile and a half from Belvidere numbers of *Griburius montezumæ* var., a very handsome chrysomelid were taken, resting and mating on the cave roof. A variety of this without elytral markings was found in a similar cave a week later in Ellsworth County, by the Kansas University expedition. In 1919 the writer took *Griburius montezumæ* near Bellvue, southwest Utah, in June, on live oak foliage. Their feeding habits were not noted at Belvidere or in Ellsworth County.

*Pelidnota punctata* Linn. larvæ, pupæ, and newly transformed imagoes were found in a decayed elm log on Medicine Lodge Creek at Belvidere. At light, *Phyllophaga summucida* Lec., *Polyphylla hammondi* Lec., *Cicindela macra* Lec., *Helluomorpha præusta* Dej., *Macrobasis immaculata* Say. and *unicolor* Kirby were not uncommon.

The last half of May and the first half of June, *Leonidia neomexicana* Cockerell emerged in numbers from the urn cells of *Anthophora occidentalis* Cresson, a solitary bee in the cell of which *Leonidia* is parasitic, the larvæ of *Leonidia* feeding on the food stored for the larvæ of *Anthophora*. A male and female of *Leonidia*, a few hours after emergence, were confined in a test tube. They mated at once, and the female deposited many eggs in the tube. The larvæ emerged in four or five days in large numbers. They were very small and light yellow. They lived from five to ten days and were extremely active, moving over the glass surface very swiftly for such minute animals.

*Leonidia neomexicana* was described by Professor T. D. A. Cockerell in 1898 from specimens reared from bee cells at Mesilla, New Mexico. In 1911 Professor Creighton Wellman described specimens collected in Logan and Grove Counties by the Kansas University entomological expedition in 1910 as *Hornia gigantea*. Specimens of *Hornia gigantea* placed in the hands of H. C. Fall at Tyngsboro, Massachusetts, in the latter part of 1922, and compared by him with specimens of *Leonidia* in his collection showed that *Hornia gigantea* was a synonym of *Leonidia neomexicana*.

Four specimens of *Bolboceriosoma* received from Mr. W. J. Brown, Stillwater, Payne County, Oklahoma, and one specimen

from Rush County, Kansas, proved to be *biplagiatum* D. & McC. *B. bruneri* D. & McC. seems to be distributed over central and northern Kansas, *biplagiatum* over the south half and *pusillum* D. & McC., over the northeastern part. So far, only *bruneri* has been taken at McPherson.

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## TWO MINOR PESTS FROM EUROPE (LEPIDOPTERA, PLUTELLIDAE).

We have been running a trap light again on the Cornell campus at Ithaca, New York, this year and have obtained specimens of two introduced Lepidoptera of a certain interest (see Canadian Ent. 55, 151).

*Ocnerostoma piniariella* Z. (European Pine Leaf-miner). Numerous specimens were taken in the first half of July, and the species is obviously well established. I think it has never been reported from the New World, but was taken here by Comstock in 1882. It has not been seen in the meantime, but is so minute and obscure, that it has probably been overlooked. It looks like a *Coleophora*, being slender, with a slightly ruffled head, forming a sort of ragged eyecap over the bases of the antennæ, but unlike *Coleophora* it throws its antennæ back when at rest. It is nearly white when fresh, but the hind wings and under side are gray, and even slightly rubbed specimens appear ash gray. Dead specimens may be distinguished from *Coleophora* by the well developed epiphysis on the fore tibia, as well as the different venation (see Spuler, Schmetterlinge Europas, vol 2, fig. 200).

*Cerostoma xylostella* L. (Honeysuckle Leaf-roller). This striking species is well known about Boston, but appeared at Ithaca for the first time this July, three specimens being taken in the trap and another seen. It is chocolate brown with the dorsal edge of the wings and the middle of the thorax bright yellow; it throws its antennæ forward at rest like the other close relatives of *Plutella*, and this and its large bushy palpi give it a certain likeness to a caddis fly (say *Triænodes borealis*).

WM. T. M. FORBES.



## FROGS AS INSECT COLLECTORS.\*

BY S. W. FROST,

STATE COLLEGE, PA.

Since 1915, the writer has been accumulating data on the food of the common frogs of the Eastern United States; *Rana catesbeana* Shaw., *Rana clamitans* Latreille, *Rana sylvatica* Le Conte, *Rana palustris* Le Conte, *Rana pipiens* Schreber and *Hyla pickeringii* Holbrook. The frogs for this study were collected in Pennsylvania and New York state throughout the summer months from April until November. They were immediately placed in formaldehyde or alcohol to prevent further digestion of the contents of their stomachs. Many of the frogs examined by previous workers were not collected for food examination and much valuable material was lost because the digestion continued until the frogs were pickled upon return to the laboratory. The contents of the stomachs were examined by the wet method, that is under alcohol or formaldehyde as it was found that delicate structures such as the wings of insects or larval skins could not be adequately detected when dry. An attempt was made to collect one hundred specimens of each species a month in order that a thorough study of their food might be made. By conducting the work in this manner, the variety that occurs in the food diet throughout the season, the differences in the food diet of the various species, their feeding activities during the breeding season and their activities during the day time and the night time could be determined.

In the course of the study, it was soon realized that insects and Crustacea form the principal diet of frogs and that they are often unconsciously excellent collectors of certain rare insects. Several interesting and valuable records of the distribution of insects have been secured from specimens taken from the alimentary canals of frogs. They appear in many cases to be better collectors than some entomologists. Their proximity to the

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\*This work was done at Cornell University under the direction of Dr. A. H. Wright and was presented before the Ecological Society of America at Boston, December 28, 1922.

ground, alertness and ability to reach places where man finds it difficult, no doubt account for this.

The food of frogs, in general, consists of several groups of animals: Annulata (worms), Mollusca (snails), Crustacea (crayfishes), Arachnida (spiders, scorpions, mites, etc.), Hexapoda (insects), and Amphibia (frogs). The latter reveals their cannibalistic habits. Some writers, on the presence of a feather or mammal's hair, include the Aves and the Mammalia in the food list. The writer, after an examination of over five hundred frogs, is unable to add these as food, although bird feathers were found on two occasions within the stomachs of frogs. An extraordinary bit of diet was found in a bullfrog, now in the collection at Cornell University, which swallowed a young alligator; the tip of its tail was protruding from the frog's mouth at the time the specimen was observed. Such unique morsels of food are sometimes found, but they are unusual rather than the favorite diet of the frogs. There is no doubt, that amid the great variety of food, insects form their principal diet. This is true, unless it be one species, *Rana catesbeana*, which has been more often found filled with Crustacea and Arachnida.

The problem of the food of frogs resolves itself, in a large degree, to a study of their insect diet and it is natural therefore that an abundance of interesting notes have been secured on insect distribution. In identifying the food contents of frogs, the orders, families, genera and in many cases the species have been determined. The identification of the species has been left to specialists. The work was conducted at Ithaca, N. Y., where the following specialists were available: Dr. O. A. Johannsen (Diptera), Dr. Wm. T. Forbes (Lepidoptera), Prof. C. R. Crosby (Arachnida), Dr. J. C. Bradley (Hymenoptera), Mr. Henry Dietrich (Coleoptera adults). Mr. Adam Bööving of Washington, D. C., was kind enough to determine the Coleoptera, larvæ. The efforts and co-operation of these systematists have greatly enhanced the value of the work. Much of the material is still undetermined including the Lepidoptera and the Hymenoptera, however considerable data have been accumulated on the Diptera, Coleoptera and Arachnida, which add greatly to our knowledge on this subject.

The determination of the contents of the alimentary canal is not a difficult task but is often tedious work. Upon the first examination of the contents of a stomach, nothing but a mass of material can be distinguished. This must be carefully picked apart before any material can be determined or even before insects or other forms can be recognized. Earth worms crowd the alimentary canal with considerable earth, moths, with scales, caterpillars, with hair, and in addition to these, one finds gravel, stones, leaves, seeds and other foreign material. Within the intestine the food is found in a more moist condition, and there is usually very little material at any time. The colon is often jammed with a quantity of material much of which is considerably digested and frequently beyond recognition. The elytra of beetles, heads and legs of many insects often remain to tell the story while the wings of insects may be badly twisted and torn, but still they can be unfolded and the family, genus and sometimes the species determined.

An extraordinary wide variety of insects has been secured from the contents of the alimentary canals of frogs. Representatives of fifteen of the nineteen order of insects recognized by Prof. J. H. Comstock have been taken and numerous families and genera are represented. The two parasitic orders Siphonaptera and Mallophaga would probably never be found unless taken upon their hosts. There is no reason to doubt that the other two orders might be eaten by frogs should they come in their path. Sometimes only a single specimen of a species was found, while at other times a large number of specimens was taken. Ants and beetles, especially the Carabidæ and the Curculionidæ, form a large part of their diet. In one case 53 ants were found in a single stomach of a bullfrog, while in another, 114 were found. The beetles are mostly large and dark colored and form attractive food for the frogs. Twelve Curculionidæ (*Phyxeles rigidus* Say), were taken from a single stomach. Flies (Diptera) likewise were found, at times, in large numbers. In opening the stomach of a green frog, the writer found fifteen specimens of *Eristalis arbustorum* (Syrphidæ). Other insects, as the Collembola, aphids, psocids and such as naturally occur in colonies, were often found in large numbers. Two groups of Arthropods, the Hexapoda and Arachnida, have thus far been found exceedingly interesting and in such

good condition that a large number of species has been determined. The larvæ of the Stratiomyidæ (Diptera) and the Arachnida (spiders) have yielded new distribution records for the fauna of New York State.

The adults of the Stratiomyidæ have not been found abundant but the larvæ have attracted much attention. These have been taken from the green, bull and meadow frogs. They are among the most beautiful of the dipterous larvæ and are readily recognized amidst the trash of the stomach contents. Five genera have been taken from frogs; *Stratiomyia*, *Odontomyia*, *Nemotelus*, *Allognosta* and *Oxycera*. The larvæ of the first five genera are known to be aquatic in their habits. *Odontomyia* adds a new larva of a local species to the collection at Cornell University. That of *Nemotelus* lends the first larval record of a North American species. Such a variety of stratiomyid larvæ is more than a dipterist has in his own collection. These larvæ were found in a beautiful condition. The weak acids of the frog's stomach remove the fatty material from the larvæ and render them in as fine a condition as specimens treated with weak potassium hydroxide at the laboratory. The skins are thereby made transparent and reveal the setæ and head structures clearly. The skins of such larvæ can be very easily determined.

Spiders were likewise found in abundance and many times in excellent states of preservation. Often it was necessary to do much cleaning before the spider was even visible because the legs would frequently curl up and entangle large masses of digested food. The male palpi, a valuable character in taxonomic work, are made more distinct and are often extended to their full length by the action of the digestive fluids of the frog. Such specimens are frequently more tempting to the systematists than poorly collected or preserved material. Spiders were found in greatest abundance in the pickerel, meadow, green and wood frogs. Fourteen species have been determined; *Pirata insularis* Em., *Pardosa moesta* Beck and *Clubiona abbotii* Koch were taken most frequently. *Schizocosa crassipalpis* Em., adds a new record to the list of spiders of New York State. Three specimens of this species were taken; two from a meadow frog and one from a pickerel frog.

As one studies the food of frogs, one realizes more and more that the food is gathered from insects dwelling on or near the ground or near the surface of the water. The Carabidæ, living near the ground, the snout beetles (Curculionidæ), dropping to the ground when disturbed, the Syrphidæ hovering over ponds, the water striders and beetles living on the surface of the water; all of these make inviting and easily obtainable food. The amount of food taken from the water, as aquatic larva, is considerable and greater than has been hitherto stated. In addition to the food and trash found in frogs, large numbers of parasites have been found. These cannot be properly considered as food but their presence is worth mentioning. *Hyla pickeringii* yielded large numbers of nematodes. Flukes also were found in some frogs.

The records thus far secured, have been a great incentive to continue the work, not alone for the valuable contribution it may be to a study of the food of frogs, but also for the possibility of adding new records and new species to our fauna. This study has opened a new field for exploitation and a new source for records of insects' distribution.

#### LARVAE OF INSECTS RECOVERED FROM THE ALIMENTARY CANALS OF FROGS.\*

Order, Family, Species.	Number of specimens recovered.
LEPIDOPTERA	
Satyridæ	
<i>Satyrodes acanthus</i> Linn. ....	2
Geometridæ	
<i>Xanthrohoe</i> sp. ....	1
Lasiocampidæ	
<i>Malacosoma disstria</i> Hubn. ....	1
Gelechiidæ	
Undetermined species ....	1
Noctuidæ	
<i>Nephelodes emmedonia</i> Cram. ....	1
<i>Catocala</i> species ....	1

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\*Many of the Lepidoptera and all of the Hymenoptera are still undetermined.

Order, Family, Species.	Number of specimens recovered.
<i>Leucania</i> species .....	1
<i>Noctua</i> species .....	1

## COLEOPTERA

Carabidæ	
<i>Pterostichus</i> species .....	3
<i>Chlaenius</i> species .....	4
Dytiscidæ	
<i>Agabus</i> species .....	1
Hydrophilidæ	
<i>Hydrobius globosus</i> Say .....	1
<i>Tropisternus</i> species .....	1
Silphidæ	
<i>Silpha</i> species .....	1
Staphylinidæ	
<i>Quedius</i> species .....	1
Histeridæ	
Undetermined species .....	1
Lampyridæ	
<i>Photinus</i> species .....	1
<i>Telephorus</i> species .....	9
Chrysomelidæ	
<i>Leptinotarsis</i> species .....	1

## DIPTERA

Mycetophilidæ	
<i>Sciara</i> species .....	4
Tipulidæ	
<i>Tipula bella</i> .....	1
Muscidæ	
Undetermined species .....	1
Stratiomyidæ	
<i>Oxycera picta</i> V. d. W. ....	1
<i>Stratiomyia</i> species .....	3
<i>Nemotelus</i> species .....	1
<i>Odontomyia</i> species .....	1
<i>Allognosta</i> species .....	1

## NEUROPTERA

Chrysopidæ	
<i>Chrysops</i> species .....	1

ADULT INSECTS RECOVERED FROM THE ALIMENTARY  
CANALS OF FROGS.†

Order, Family, Species.	Number of specimens recovered.
THYSANURA undetermined	
EPHEMERIDAE undetermined	
ODONATA undetermined	
PLECOPTERA undetermined	
CORRODENTIA undetermined	
ORTHOPTERA	
Blattidæ	
<i>Parcoblatta pennsylvanica</i> De. Geer.....	1
PHYSOPODA	
Undetermined	
HEMIPTERA	
Jassidæ	
<i>Helochara communis</i> Say .....	6
<i>Draeculacephala aquilifera</i> Walk.....	1
Tingitidæ	
<i>Corythucha juglandis</i> Say .....	2
Hydrobatidæ	
<i>Gerris remigis</i> Say .....	2
<i>Gerris marginata</i> Say.....	4
Reduviidæ	
<i>Reduviolus fesus</i> L .....	1
Pentatomidæ	
<i>Euschistus castignus</i> Say .....	1
<i>Euschistus fissilis</i> Uhl. ....	1
Saldidæ	
<i>Lampracanthia anthracina</i> Uhler .....	1
Corimelaenidæ	
<i>Thyrecoris unicolor</i> P. B. ....	6
NEUROPTERA	
Sialidæ	
<i>Chauliodes sericornis</i> Say .....	1
Chrysopidæ	
<i>Chrysops</i> species .....	2
MECOPTERA	
Panorpidæ	
<i>Panorpa</i> species .....	1

† This list contains only material determined to genus or species. The insects of many of the orders are still undetermined.

## TRICHOPTERA

Undetermined

## LEPIDOPTERA

Undetermined

## DIPTERA

## Chironomidæ

*Chironomus decorus* ..... 1

## Mycetophilidæ

*Sciara* species ..... 2

## Tipulidæ

*Tipula bella* Loew ..... 1*Tipula dietziana* Alex. .... 1*Tipula* near *tephrocephala* Loew. .... 1*Erioptera graphica* O. S. .... 1*Erioptera armata* O. S. .... 2*Gonomyia subcinerea* O. S. .... 2*Gonomyia sulphurella* O. S. .... 1*Pilaria tenuipes* Say. .... 1*Ptychoptera rufocincta* O. S. .... 1

## Trypetidæ

*Urellia* species ..... 1*Eutreta* species ..... 2

## Platypezidæ

*Platypeza* species ..... 1

## Syrphidæ

*Eristalis arbustorum* ..... 15

## COLEOPTERA

## Cicindelidæ

*Cicindela sexguttata* Fab. .... 1

## Carabidæ

*Bembidium nigrum* Say. .... 1*Bembidium flavopictum* Mots. .... 1*Pterostichus* species ..... 1*Poecilus lucublandus* Say ..... 18*Amara insensu* L. & H. .... 1*Platynus melanarius* Dej. .... 3*Platynus tenuis* Lec. .... 2*Platynus excavatus* Dej. .... 1*Lebia* species ..... 1*Chlaenius* species ..... 1*Harpalus dichrous* Dej. .... 1*Stenolophus fuliginosus* Dej. .... 1*Stenolophus riparius* L. .... 1*Anisodactylus* species ..... 3*Micromaseus patruelis* (Dej.) ..... 1



<i>Pseudargutor erythropus</i> (Dej.) .....	1
<i>Triacna angustata</i> (Say.) .....	6
<i>Triliarthrus kirbyi</i> (Horn) .....	1
Dytiscidæ	
<i>Agabus semivittatus</i> Lec. ....	1
Hydrophilidæ	
<i>Helophorus</i> species .....	1
<i>Creniphilus</i> species .....	1
Bostrichidæ	
Undetermined .....	1
Cupesidæ	
<i>Cupes concolor</i> Westw. ....	1
Scarabaeidæ	
<i>Aphodius fimetarius</i> Linn. ....	1
<i>Ataenius cognatus</i> (Lec.) ....	1
Chrysomelidæ	
<i>Donacia rufa</i> Say .....	6
<i>Calligrapha similis</i> Rogers .....	1
<i>Calligrapha philadelphica</i> Linn. ....	1
<i>Calligrapha elegans</i> Oliv .....	2
<i>Calligrapha bisbyana</i> Kirby .....	4
<i>Lina interrupta</i> Fab. ....	1
<i>Lina lapponica</i> (L) .....	1
<i>Cerotoma trifurcata</i> Forst .....	6
<i>Prasocuris vittata</i> Oliv. ....	2
<i>Leptinotarsa decimlineata</i> Say .....	1
<i>Galerucella nymphaeae</i> L. ....	8
<i>Diabrotica 12 punctata</i> Fabr. ....	1
<i>Oedionychis vians</i> Illig. ....	1
<i>Disonycha pennsylvanica</i> Illig. ....	1
<i>Disonycha xanthomelaena</i> Dalm. ....	2
<i>Mantura floridana</i> Crotch .....	1
<i>Systena taeniata</i> Say .....	1
<i>Anthoboscus ruricola</i> (Oliv.) ....	1
Anthicidæ	
Undetermined species .....	15
Staphylinidæ	
<i>Staphylinus mysticus</i> Erichs. ....	1
<i>Philinothus</i> species .....	4
<i>Stenus</i> species .....	4
<i>Lathrobium</i> species .....	1
<i>Palaminus testaceus</i> Erichs. ....	1
<i>Gastrolobium bicolor</i> (Grav.) ....	1

Coccinellidæ	
<i>Hippodamia parenthesis</i> Say	1
<i>Hippodamia 13 punctata</i> Linn.	2
<i>Coccinella transversoguttata</i> Fald.	1
<i>Adalia bipunctata</i> (L)	1
<i>Hyperaspis undulata</i> (Say)	2
<i>Chilocorus bivulnerus</i> Muls.	1
<i>Ceratomegilla maculata</i> De Geer	4
<i>Ceratomegilla fuscilabris</i> (Muls)	1
Erotylidæ	
<i>Languria mozardi</i> Latr.	1
Cryptophagidæ	
<i>Ceratophagus abbreviatus</i> Say	9
<i>Tomarus pulchellus</i> Lec.	3
<i>Atomaria</i> species	1
<i>Anchicera ephippiata</i> Zimm.	1
Dermestidæ	
<i>Dermestes lardarius</i> Linn.	1
Nitidulidæ	
<i>Epuraea helvola</i> Erichs	1
Lathridiidæ	
<i>Corticaria</i> species	1
Heteroceridæ	
<i>Heterocerus</i> species	5
Byrrhidæ	
<i>Limnichus punctatus</i> Lec.	1
Dasyllidæ	
An undetermined species	1
Elateridæ	
<i>Melanotus</i> species	1
<i>Agriotes mancus</i> (Say)	15
<i>Ludius tarsalis</i> (Melsh)	3
<i>Monocrepidius auritus</i> (Hbst.)	2
<i>Dolopius lateralis</i> Esch.	1
Dryopidæ	
<i>Helicus lithophilus</i> (Germ.)	1
Lampyridæ	
<i>Photinus</i> species	1
Curculionidæ	
<i>Phyxeles rigidus</i> Say.	12
<i>Homorus undulatus</i> (Uhler)	1
<i>Brachyrhinus rugifrons</i> Gyll	11
<i>Brachyrhinus ovatus</i> Linn.	11
<i>Sitonia hispidula</i> Fab.	4
<i>Phytonomus nigrirostris</i> Fab.	1

<i>Hyperodes porcellus</i> Say .....	7
<i>Notaris puncticollis</i> (Lec.) .....	2
<i>Onychylis nigerostri</i> Boh. ....	1
<i>Anthonomus</i> species .....	1
<i>Centorhynchus marginatus</i> Payk. ....	2
<i>Conotrachelus anaglypticus</i> Say. ....	1
<i>Cryptorhynchus lapathi</i> Linn. ....	1
<i>Hypera punctata</i> (Fab.) .....	6

# ARACHNIDA RECOVERED FROM THE ALIMENTARY CANALS OF FROGS.

Family, Species.	Number of specimens recovered.
<b>Clubionidæ</b>	
<i>Clubiona</i> species .....	2
<i>Clubiona abbotii</i> Koch. ....	3
<i>Clubiona mixta</i> Em. ....	1
<b>Lycosidæ</b>	
<i>Lycosa</i> species .....	3
<i>Lycosa erratica</i> Hlz. ....	1
<i>Pirata insularis</i> Em. ....	3
<i>Pirata febriculosus</i> Beck .....	1
<i>Pardosa moesta</i> Banks. ....	4
<i>Pardosa milvina</i> Hlz. ....	1
<i>Schizocosa crassipalpis</i> Em. ....	1
<b>Thomisidæ</b>	
<i>Oxyptila conspurcata</i> .....	3
<i>Xysticus ferox</i> Hlz. ....	6
<b>Mimetidæ</b>	
<i>Ero furcata</i> Vill. ....	1
<b>Linyphiidæ</b>	
<i>Erigone</i> species .....	3
<i>Linyphia calthrata</i> .....	2
<b>Agelenidæ</b>	
<i>Agelena naevia</i> .....	1
<b>Attidæ</b>	
<i>Stitticus palustris</i> Peck. ....	1
<b>Cheliferidæ</b>	
An undetermined species .....	1





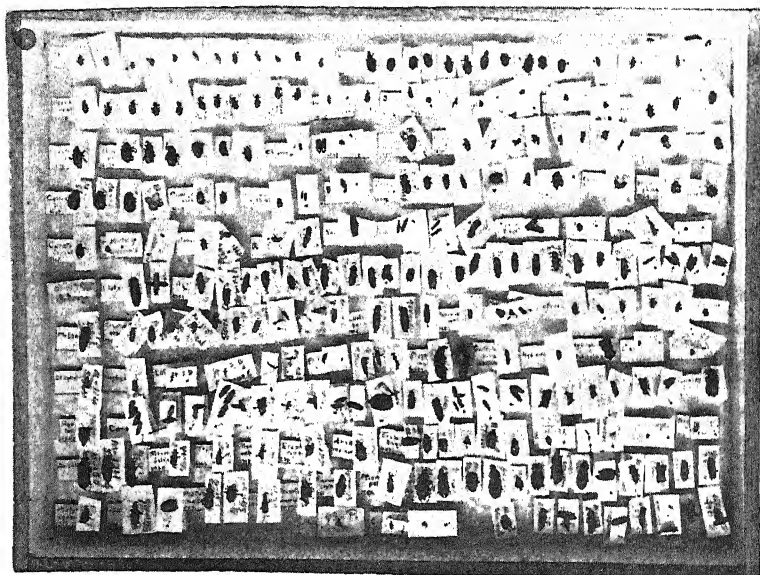
1.



2.



3.



4.

FROGS AS INSECT COLLECTORS.

## EXPLANATION OF PLATE XIV.

- Fig. 1. Alimentary canal of Wood frog showing ;  
    (a) stomach,  
    (b) intestine,  
    (c) colon.
- Fig. 2. Compact mass of food from stomach before separation for determination.
- Fig. 3. Contents of the same stomach shown in figure 2 after pick-apart, showing body, head legs and ovipositor of cricket, hairs of lepidopterous larva and hemlock leaves.
- Fig. 4. A collection of *Coleoptera* taken from alimentary canals of frogs showing the fine state of preservation of some and the method of labelling.

## NOTES ON THE BUPRESTIDAE OF OREGON WITH DESCRIPTIONS OF NEW SPECIES.

BY W. J. CHAMBERLIN,

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The Buprestidæ are usually considered as tropical insects, yet some 380 species are known from the United States and sixty-three of these have been taken in Oregon. Of the sixty-three species listed, fifty-six are represented by Oregon specimens in the author's collection. Two of the remaining species have been seen bearing Oregon labels and the other five are included on the best of authority such as that of Leconte, Horn and Fall.

Sixteen of the species listed below have not been reported heretofore from Oregon and two new species are herewith described.

The Oregon species belong in twelve different genera, as follows:

### I. *Chalcophora* Sol.

1. *C. angulicollis* Lec. A common species throughout the state.

### II. *Dicerca* Esch.

2. *D. prolongata* Lec. Quite common on *Populus tremuloides*; occasionally found on willow.
3. *D. pectorosa* Lec. This species is becoming a serious pest in orchards working in the lower trunks and roots of prune trees. Its native hosts are *Prunus subcordata* and *P. demissa*.
4. *D. tenebrosa* Kirby. Quite common breeds in *Pinus* and *Abies*.
5. *D. sexualis* Crotch. Not common, occurs early on Douglas Fir.
6. *D. horni* Crotch. Rare, found in oak regions of southern Oregon.
7. *D. lurida*. Fab. A single specimen of this typical eastern species was taken at Corvallis on June 30th. It has probably been introduced and may become established here as Dr. Burke reports *D. obscura* as breeding in ash in California. This species not previously reported from Oregon.

### III. *Trachykele* Mars.

8. *T. opulenta* Fall. Only two specimens of this rare beetle have been taken here to my knowledge, one flying at Corvallis, May 4; another chopped from its pupal cell in *Libocedrus decurrens* at Detroit on Sept. 6. It also attacks *Thuja plicata* and *Sequoia gigantea*.
9. *T. blondeli* Mars. The work of the larvæ of this beetle is very common in cedar from the coast up to 2000 feet and a quantity of the larvæ may be chopped out at any season of the year. The adults are seldom seen. Most of the specimens in collections have been taken from their pupal cells, usually dead. Many individuals become mature but for some reason fail to cut their way out of the tree. Fully mature, apparently normal adults were found June 26 in their cells in cedar at Oakridge, Oregon, having made no effort to cut through the one-eighth of an inch of bark covering the large pupal cell. Much loss is occasioned by the larval mines in cedars, some operators estimating their loss to shingle material at from 15 to 30 percent of the cut, over limited areas. The reported hosts for this species are *Thuja plicata*, *Juniperus occidentalis*, *Cupressus macrocarpa*, *C. sargentii* and *C. macnabiana*.
10. *T. nimbosea* Fall. This dark bronze species is even more rare than the green forms. The hosts are the true firs of the genus *Abies*. The Oregon records are Yamhill VII-14; Corvallis V-28; Ashland IX-1 and Forest Grove VIII-7.

### IV. *Pœcilonota* Esch.

11. *P. cyanipes* var. *californica* Chamb. This species is very common in certain localities on *Populus tremuloides*.
12. *P. montanus* Chamb. This species was apparently known only by the type material from Montana until recently. In June of the present year five females were taken near Oakridge, Oregon, ovipositing in the bark of injured *Populus trichocarpa*.



V. *Buprestis* Linn.

13. *B. aurulenta* Linn. Our most abundant species, appearing as early as March. Breeds in Douglas fir, various pines, firs and spruces. Several unusual records of the longevity of the larvæ of this species have come to our notice. Typical of these is a recent letter, reproduced below:

Portland, Oregon,  
4/23/24.

To whom it may concern:—

This bug was found last evening whilst working out of the hand railing of our stairs. The railing has been varnished and kept so for nine years to my knowledge and has shown no previous borings for the deposit of the egg. It came out at the top surface from a depth of about  $\frac{5}{8}$  in. I do not know that the bug is out of the ordinary run of such bugs, but the question in my mind is how long has it taken for development. If it is not asking too much, I would like to hear your opinion regards same.

Yours very truly,

C. H. Charlton, D. C.,  
606 E. 10th St., So.,  
Portland, Ore.

The specimen submitted with the letter was a living example of *B. aurulenta*.

14. *B. adjecta* Lec. This beautiful species is quite widely distributed but rare. Supposed to breed in *Pinus ponderosa*, and *P. contorta*. Specimens in the National Museum bear the host labels *Pseudotsuga taxifolia*, *Abies magnifica* and Jeffrey pine.
15. *B. rusticorum* Kby. A common species throughout the state. Breeds in Douglas fir and various *Abies*.
16. *B. subornata* Lec. Similar to the last, common in the pine belt. The preferred host is yellow pine.

17. *B. læviventris* Lec. A common species, often very abundant around saw mills and old logs. Adults feed on needles of young pines.
18. *B. confluenta* Say. For years I have been expecting this species to be taken in eastern Oregon but not until this year did it appear and then not in the eastern portion of the State. A beautiful male was picked up on the sidewalk in Corvallis June 30, 1924, by J. Wilcox, the first recorded specimen for Oregon.
19. *B. viridisuturalis* N. and W. Several specimens have been taken on black cottonwood in the vicinity of Corvallis.
20. *B. fasciata* Fab. A rather common species.
21. *B. Gibbsii* Lec. A rare species. I have seen some eight specimens taken in Oregon. Mostly flying. One taken July 1, 1924, on ash cordwood. Breeds in oak.
22. *B. connexa* Horn. A rare species taken from yellow pine by the author some years ago. In 1922 with Dr. Van Dyke, a series of this species was taken at an old saw mill near Halfway, Oregon. There were some 20 logs in the mill yard, part were yellow pine and part were Douglas fir. Much to our surprise we found the females selecting the fir, in preference to the pine for egg deposition. The beetles fly only during the intense heat of mid-day. Taken July 4, 5 and 6.

#### VI. *Melanophila* Esch.

23. *M. miranda* Lec. Reported from Oregon by Dr. Le Conte.
24. *M. acuminata* De Geer. A common species, breeding in *Pinus* and *Abies*.
25. *M. drummondi* Kby. This is probably the most abundant species of Buprestidæ in Oregon. It breeds in practically all our conifers except the cedars and junipers. I have also taken it ovipositing in living cottonwood. (*P. trichocarpa*).  
*Atanycolus* (*Bracon*) *montivagus* Cress. and *Helcon*

*fulvipes* are important parasites often destroying over 50 percent of the broods.

26. *M. consputa* Lec. Taken in small numbers in Klamath County around forest fires.
27. *M. gentilis* Lec. Quite common in the yellow pine regions.
28. *M. Pini-edulis* Burke.\* A single specimen taken by M. J. Miller in Jackson county.
29. *M. californica* Van Dyke. This species not previously reported from this state is quite common on yellow pine reproduction.
30. *M. intrusa* Horn. Not previously reported from Oregon. Taken at Klamath Falls VII-9; Sparta VII-2; Halfway VII-4; La Grande VII-9 and Corvallis VII-4. All specimens taken on yellow pine reproduction.

#### VII. *Anthaxia* Esch.

31. *A. æneogaster* L. & G. Abundant. Breeds in twigs of yellow pine, Douglas fir, redwood, willow, mountain mahogany, oak and several bushes, rose, rhodendron, redbud, etc.
32. *A. deleta*. One specimen in the National Museum collected by Schwarz at Portland V-28. I have collected numbers of them near Klamath Falls VII-9; Corvallis VII-4; VII-17; Oakridge VI-29; Ashland VII-2; La Grande VII-9. Most conveniently taken beating young yellow pine, in the twigs of which it breeds. Taken on the flowers of wild lilac at Oakridge.

#### VIII. *Chrysobothris* Esch.

33. *C. femorata* Fab. Fairly common in the aspen stands of eastern Oregon, occasionally found in orchards and on cottonwood and alder.
34. *C. contigua* Lec. Abundant in the yellow pine forests.
35. *Chrysobothris lilaceous* new species.

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\*Since seeing Dr. Burke's specimens of the true *M. pini-edulis*, I am somewhat doubtful of the identity of this Oregon specimen.

Color dark lilac bronze, thorax reddish, antennæ dark coppery bronze, first segment as long or longer than the second and third, third about as long as next two combined; front coppery with two prominent callosities and irregular raised areas coarsely punctured, rather densely clothed with white pubescence on the depressed areas; clypeus rather deeply triangularly notched (fig. 5); thorax twice as wide as long with prominent, dark median smooth area extending two-thirds from the base flanked on each side by a large irregular round area on the anterior half, a smaller less prominent one near the lateral margin; surface otherwise coarsely strigosely punctured. Elytra wider than thorax, parallel about one-half the way back then gradually narrowed to the apex, margin serrulate, first costa distinctly elevated on the apical half merging into a rather broad elevated smooth space on the basal half, four basal foveæ deep and distinct, surface with numerous raised dark areas which have few punctures and these near their margins, balance of surface moderately densely, coarsely punctured. Body beneath, coppery bronze coarsely punctate; last ventral segment sinuate the emargination scarcely evident (fig. 6). Length 10.5—11 mm.

In Horn's table this species runs to *cuprascens* but can be distinguished at once by its larger size, clypeus without the teeth, the strigulose thorax and the last ventral being longer and more acuminate.

Described from three females taken on juniper (*Juniperus occidentalis*) about six miles west of Klamath Falls, Oregon, June 14, 1922, in company with numerous *C. nixa* and *viridicyanea*. The host is doubtless western juniper. Type in author's collection.

36. *C. viridicyanea* Horn. Not previously recorded from Oregon but not uncommon in *Juniperus occidentalis* in the eastern and central parts of the state.
37. *C. dolota* Horn. Quite widely distributed in the pine regions but always rare.
38. *C. dentipes* Germ. Very abundant in eastern and southern Oregon, breeds in various pines.
39. *C. carinipennis* Lec. Fairly common in the pine belt.
40. *C. californica* Lec. The type of *C. vulcancia* Lec., which is considered a synonym of *C. californica* was taken in Oregon.

41. *C. pseudotsugæ* Van Dyke. Not previously reported from Oregon. One specimen taken at Ashland in August.
42. *C. laricis* Van Dyke. The type material taken in the Blue Mountains of Oregon.
43. *C. sylvania* Fall. Rare, occurs in Douglas fir, emerges early in April.
44. *C. caurina* Horn. Breeds commonly in yellow pine twigs.
45. *Chrysobothris juniperinus* new species.

Length, male, 8.5 mm., female, 9 mm. Width 3 mm. Superficial appearance somewhat as in *cuprascens*; form rather more slender; color of elytra as in *cuprascens*, thorax and head less reddish; antennæ first joint longer than the second and third combined, third joint not as long as the next two, joints 4 to 8, prominently serrate, tip much narrowed, dull bronze, darker in female; front convex with two small, distinct callosities; dull bronze more reddish in female, coarsely closely punctured and clothed with long white pubescence, male, less so in female. Clypeus acutely notched (fig. 3); thorax more than twice as wide as long, widest in front of the middle, base and apex rather abruptly narrowed, disc irregular, no median depression, a shallow fovea near each lateral margin, surface densely evenly punctate, except where broken by slightly elevated, dark smooth areas. Elytra wider than thorax, sides almost parallel (slightly sinuous), one-half the way back, narrowing thence to the apices, margin serrulate, prominent basal foveæ, flanked by a smaller less distinct one near the outer margin; first costa distinctly elevated entire broadening out at basal third, second and third faintly evident on the raised areas; irregular raised areas occupy almost one-half the elytral surface (mainly on the basal half), these are dark, smooth, shining with a few scattered small punctures, balance of surface bronzed, moderately punctate. Under surface bronze with long white pubescence covering the prosternum, male, shorter and less dense on other parts of ventral surface; last ventral segment of male (fig. 1) with a broad semi-circular emargination; last ventral of female (fig. 2) with only a faint notch.

Prosternum distinctly lobed, the anterior tibiæ of male arcuate and dilated at the tip (fig. 4) placing the species in Dr. Horn's Group IV near *caurina* from which it is easily separated by the tibiæ, color of front and the emargination of the last ventral segment, which lacks the lateral raised areas so prominent in *caurina*.

Described from a single pair taken on freshly cut juniper (*Juniperus scopulorum*) posts in the Stein Mountains (7500 ft.

altitude), Harney County, Oregon, June 22 and June 24, in company with *C. viridicyanea*.

Another pair taken at the same place show no distinct characters by which they may be separated but are somewhat larger measuring 10.5 mm. in length and 4 mm. in width.

The host is undoubtedly the Rocky Mountain Juniper which is the only conifer in the Stein Mountains.

46. *C. breviloba* Fall. A single specimen taken in Eastern Oregon.
47. *C. monticolæ* Fall. Four specimens taken in the Warner Mts. Lake county June 19, on yellow pine.
48. *C. mali* Horn. This species has forty-four recorded host plants. In Oregon it is becoming a serious pest in prune, peach and walnut orchards. Hundreds of young trees have been killed shortly after being set out. It is also quite injurious to young shade trees.
49. *C. nixa* Horn. Occurs in southern Oregon in *Juniperus occidentalis*. Not previously reported from this state.
50. *C. pubescens* Fall. One specimen taken on Mt. Jefferson VII-20 seems to belong to this species. There is no other record of its occurrence here.
51. *C. deleta* Lec. A rare species which probably breeds in twigs of yellow pine. Two specimens, one flying at Condon VII-8, the other on yellow pine trimmings at Sparta VII-3.
52. *C. cyanella* Horn. I know of only three specimens of this species having been taken in Oregon. All were taken near Ashland. Breeds in yellow pine twigs, flies during June and July. Not previously reported from this State.

#### IX. *Polycesta* Serv.

53. *P. californica* Lec. Two specimens have been taken, one at Ashland, Oregon, by J. M. Miller and one at Gold Hill by the author.

**X. Acmaeodera Esch.**

54. *A. variegata* Lec. One specimen in the National museum bears a label "Hood River, Oregon" V-21-1892. (Hubbard & Schwarz.) Fall says "*variegata* extends its range into eastern Oregon." No other species of this genus has been recorded from Oregon but the following three species occur here.
55. *A. connexa* Lec. Quite common in the open spaces of the yellow pine forests of southern Oregon. Most abundant on one of the woolly sunflowers, (*Eriophyllum lanatum*), I have taken only one specimen in any locality where mountain mahogany was not common and believe it breeds in that plant.
56. *A. vandykei* Fall. Several specimens taken on mountain mahogany (*Cercocarpus parvifolius*) west of Klamath Falls in June. One specimen at Sparta July 3.
57. *A. gemina* Horn. One specimen taken at Prospect on the Crater Lake Highway Aug. 10, 21 by Prof. A. L. Lovett.

**XI. Chrysophana Lec.**

58. *C. placida* Lec. Widely distributed in the southern portion of the state, but never common. Occasionally taken in the Willamette Valley as far north as Portland.

**XII. Agrilus Steph.**

59. *A. vittaticollis* Rand. Two specimens, Corvallis. One taken years ago flying. The second beaten from service berry VI-23-1924 by B. G. Thompson.
60. *A. niveiventris* Horn. Reported from southern Oregon by Dr. Fall. One specimen taken on Oregon alder near La Grande July 9. A series taken on black cottonwood and Oregon alder at Oakridge May 29 and June 28.
- A. anxius* Gory. Taken just over the Oregon line in Idaho and no doubt occurs in this state though so far as known no specimens have been taken.

61. *A. walsinghami* Cr. "Josephine County Oregon" (Horn).
62. *A. politus* Say. Common in the Cascade mountains in alder and willow.
63. *A. burki* Fisher. Occurs in limited numbers in alders.

### ULTRAVIOLET AND FLOWER-VISITING HABITS OF INSECTS.

In the "Annals of the New York Academy of Sciences" (vol. xxix, pp. 233-283, April 15, 1924) there appeared an important paper by Dr. F. E. Lutz on "The Colors of Flowers and the Vision of Insects with Special Reference to Ultraviolet", which study was made in connection with the work of the National Research Council's Committee on the Biological Relations between Flowers and Insects. Dr. Lutz discusses floral colors and insect vision and shows that such colors and insect vision can not be interpreted in terms of human experiences. Special attention is paid to ultraviolet which flower visiting insects can see and which has been practically neglected by previous investigators. It is Dr. Lutz's conclusion that "floral colors have developed simply as byproducts of the plant's metabolism; that at most they are of only incidental and minor service to insects in finding flowers and that they have not been developed by any action of natural selection".

Dr. Lutz has cleared the atmosphere around the problem and in shovelling away the accumulation of entomological debris and in his dissatisfaction with cleverly worded explanations which did not explain he has uncovered new problems intimately connected with physics, chemistry and botany and his paper automatically places in the category of "history", numerous papers on floral ecology.

Ed.



## NOTES ON THE RUSH WEEVIL, *LIMNOBARIS* *RECTIROSTRIS* LEC., IN NEW JERSEY.

BY HARRY B. WEISS AND ERDMAN WEST

The rush weevil, *Limnobaris rectirostris* Lec., which is mentioned by Smith (Insects of New Jersey, p. 395) as occurring at Hopatcong, South Orange and Newark was found by us during the season of 1923 at Weston, Griggstown, Stirling, Rocky Hill and Monmouth Junction, all in New Jersey, and the following notes refer to observations made for the most part at Monmouth Junction.

Occasional reference to the species is found in literature. Blatchley and Leng (Rhynchophora of North Eastern America) state that it ranges from New England and Canada to Michigan and Iowa, south to South Carolina. Harrington (Canad. Ent. xxiii, p. 26) says that it is found in June in wet localities upon club-rush (*Scirpus eriophorum*) in which the larva lives.

In New Jersey at Monmouth Junction, numerous adults were found on June 18 upon *Scirpus atrovirens* and to a less extent on *Scirpus cyperinus* feeding on the flower buds and making punctures in the sheath around the lower foot of the stem. Some were feeding on the tender, developing sheaths and many were found lurking in such places. Many eggs were noted at this time and were indicated by dark-reddish, longitudinal streaks on the stem, varying from three to five millimeters in length. Many of the egg punctures were found about one-half way up the stem or in the upper twelve inches. Although a few stems contained four or five eggs, most of them had but one. The female eats a channel part way in the tissue, through the sheaths and enlarges it at the end into a small, irregular egg cavity. Some cavities were almost in the middle of the stem but most of them did not reach this far. A single whitish, smooth egg is placed in each cavity and the entrance to the channel leading to the egg chamber is closed with shreds of plant tissue. The tissue around the egg and feeding punctures in the stem later becomes dark reddish in color.. Each egg is sub-cylindrical, tapering slightly at both ends which are broadly

rounded and is about 0.8 mm. long and 0.35 mm. wide. They are not unlike jelly beans in shape.

By the last of June all of the adults had disappeared and most of the eggs had hatched. After hatching the larva burrows downward making a narrow, longitudinal channel in the pith, usually close to the bark. When first hatched the larva is rather narrow and elongate but later it becomes stockier. Sometimes the channels cross from one side of the stem to the other or continue down the centre. In some cases the channel was expanded every five or six inches into little feeding pockets. By the middle of July many larvæ had reached the bottom of the stem and were feeding extensively at this point. Later they ascended their burrows to a distance of five or six inches. Practically all of the larval feeding took place in the pith and as the vascular system was uninjured no damage occurred to the plant. By the middle of August the larvæ were six or seven millimeters long and much feeding had been done in the lower twelve centimeters of the stem. In infested plants close to the water the larvæ did not descend nearly to the roots as they did in other plants but remained several inches above the ground level. During the last week of September many larvæ had started to make cells in the pith six or eight inches above the ground. In very wet places they were higher. Harrington (loc. cit.) states that the larvæ overwinter in the upper part of the burrow so as to be safe from spring flooding. The cells were from thirteen to seventeen millimeters long and from three and one-half to four millimeters wide, some of them extending the width of the stem. Each end of the cell was plugged with excrement, frass, etc. The winter is passed by the larva in the cell and transformation to the pupal stage occurs about the first or second week of May the adults issuing during the first part of June and becoming abundant about the second week. The parasite *Habrocytus languria* Ashm. (identified by Mr. S. A. Rohwer) was reared June 18 from pupæ collected in the larval burrows.

The adult was described by Leconte in 1876 (Leconte & Horn, Proc. Amer. Phil. Soc. vol. xv, p. 315) from specimens collected in South Carolina and Illinois and a description of the larva by Dr. Adam Boving will be found in the following paper.

## THE LARVA OF THE WEEVIL *LIMNOBARIS* *RECTIROSTRIS* LECONTE.

BY ADAM G. BOVING, PH. D.

BUREAU OF ENTOMOLOGY, DEPARTMENT OF AGRICULTURE, WASHINGTON, D. C.

The material on which the following description is based consists of fifteen mature larvæ of the weevil *Limnobaris rectirostris* LeConte, which kindly were sent to me for description by Mr. Harry B. Weiss, Chief, Bureau of Statistics and Inspection, State of New Jersey, Department of Agriculture, Trenton, N. J. The larvæ were collected at Monmouth Junction, New Jersey, on October 30, 1923, and have now been accessioned to the collection of coleopterous larvæ in the National Museum. When received they were preserved in alcohol. Their natural appearance does not seem to have changed greatly, except that most of them are abnormally extended resulting in the loss of distinct limitations between the different body areas.

### DESCRIPTION OF MATURE LARVA.

#### GENERALITIES:

The larva (fig. 2) is of medium size, about 8 mm. long and 2 mm. wide; it is cylindrical, more elongate than usual in the curculionids and slightly curved.

The head (fig. 6) is yellowish-brown with darker margins and on the dorsal surface with a system of broad whitish bands which form a large figure somewhat like a reversed letter A. Very characteristic is also a dark semi-circular line posteriorly on the dorsal side of epicranium, almost parallel with the outline of the head capsule when this is seen from above.

The body (fig. 2) is mainly whitish as in most other curculionid-larvæ, but anteriorly on each side of the middle line the thin, slightly colored and indistinct prothoracic shield has a yellowish-brownish spot, and likewise on prothorax are found several small patches of yellowish-brown chitinous granulations. The largest of these patches is medianly on eusternum and has the form of a short, broad, squarish kite. The two posterior thoracic and all the abdominal segments are without chitinizations.

The abdominal segments are connected by well developed inter-segmental, wedge shaped areas or cunei ( $cu_1$  and  $cu_2$ , fig. 2) which are unusually large in the middle of the abdomen, and thereby contribute essentially to the characteristic length of the larva.

Each of the first to eighth abdominal segments has three tergal lobes or pleads. The anterior (psc) of these pleads has a minute seta and the posterior (scl) one carries two setae of normal size and at least one minute. On the ventral side the sternal regions of these same segments are transversely swollen along their posterior margins probably for the sake of locomotion.

The head and footwarts are beset with several setae but most of the body-areas carry very few and often extremely fine and short ones.

The spiracles (fig. 9) are "bifore," viz., provided with a pair of air tubes, and are rather small; they are present on mesothorax and the first eight abdominal segments; a rudimentary spiracle can with high power magnification be detected at the anterior margin of mesothorax. The mesothoracic spiracle is slightly larger than the abdominal ones, it points obliquely upward and backward and the area in which it is seated is pushed into the posterior part of prothorax; however, there is a considerable distance between it and the anterior margin of prothorax. The abdominal spiracles are all of same size and point directly backward; the eighth one placed slightly more dorsal than the rest.

#### HEAD:

Is connected with the body by a large cervical collar and due to this membrane it may be deeply invaginated as well as greatly protruded from prothorax. From anterior margin of frons to the occipital foramen it is as long as wide.

Epicranial median suture somewhat longer than half of cranium. Epicranial ridge (ecc fig. 6) curved, extending from posterior end of epicranial suture forward to about the middle of the cranium and is subparallel with the lateral outlines of the head, when this is viewed from above. Each epicranial half with six setae arranged as shown in figure 6.

Ocelli (figs. 2, 6) two on each side, both reduced to pigmented optical spots. The first and decidedly the larger spot is placed

near the antenna; the second spot is behind the first and nearer than this to the middle line, is indistinct and about of the same size as one of the sensory punctures.

Frons about two-thirds the length of the epicranial suture; frontal sutures form an angle of about  $120^{\circ}$ ; median frontal carina (fc fig. 6) strong. Four minute setæ on each side on the anterior frontal margin and two long setæ on each side of the frontal plate behind its anterior margin; the arrangement and relative size of the setæ as shown in the figure; about five sensory punctures on each side.

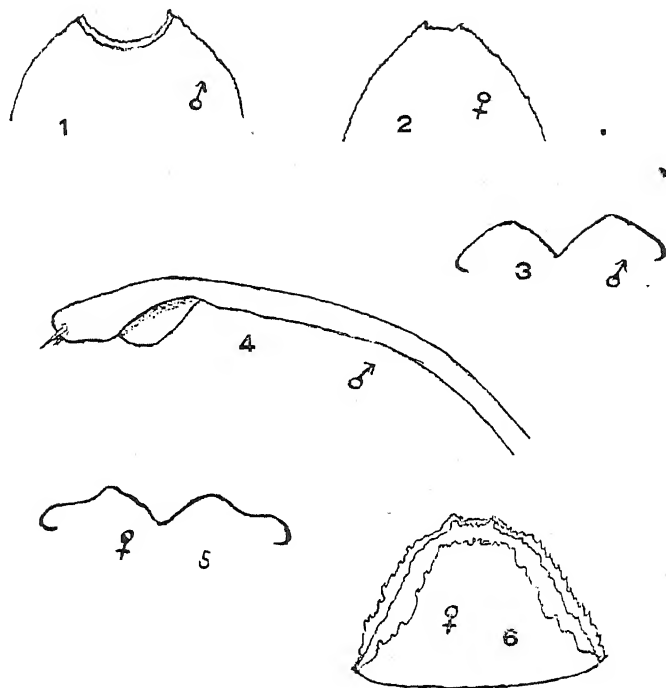
Antenna (fig. 1) very small, two-jointed. Basal joint (b) not higher but considerably wider than the apical joint, with four minute setæ and one seta as long as the apical joint. Apical joint (a) conical, without seta.

Clypeus transverse; length to width about as 1 to 3; width about half as large as distance between antennæ; widest behind; lateral margins convex. No setæ but three sensory punctures.

Labrum transverse, anterior margin convex; extreme length medianly, about as long as clypeus; width about three times the length. Dorsal face of labrum (fig. 6) on each side with three setæ, one of normal size, the two others small. Along the anterior margin on each side with a lateral group of three short, stout setæ and a median group of two of about same shape but slightly shorter. Ventral face (or epipharynx) with two setæ, one ( $e^1$ ) anterior and thick, the other ( $e^2$ ) posterior and fine and placed inside of the anterior end of the epipharyngeal rod (er fig. 7).

Mandible subtriangular (figs. 4, 5, 7), somewhat larger at base than apically; inside concave, gouge shaped; distally with five teeth, external tooth on ventral side (5 fig. 5, 7) small; inner dorsal margin anteriorly with a low, heel like projection (h figs. 4, 5, 7). One seta above the middle of external face; a few sensory punctures on dorsal face.

Maxilla (figs. 3, 8) with cardo (ca) smooth, yellowish-brown and no seta. Stipes proper (st), smooth, yellowish brown with one seta and several sensory punctures. Palpiger (g) soft, retracible; with two setæ on ventral face and two small setæ on the dorsal (buccal) face. Maxillary lobe (or mala) single, large,



EXPLANATION OF PLATE XV.

Fig. 1. Last ventral segment of *C. juniperinus* n. sp. ♂.

Fig. 2. Last ventral segment of *C. juniperinus* n. sp. ♀.

Fig. 3. Clypeus of *C. juniperinus* n. sp.

Fig. 4. Front tibiae of ♂ *C. juniperinus* n. sp.

Fig. 5. Clypeus of *C. lilaceus* n. sp.

Fig. 6. Last ventral segment of ♀ *C. lilaceus* n. sp.



reaching to the middle of apical joint of palpus; on the ventral face with several minute setæ; on the buccal face with about ten stout setæ mostly of medium length (m fig. 8). Maxillary palp (p) short, with two joints; basal joint a little longer and about twice as wide as the apical, which is conical, obtuse and about one-half time longer than wide; basal joint with about three minute setæ and some sensory punctures; apical article finely papillose at the tip; with one puncture.

Subfacial area (sf fig. 3) undivided, probably formed by a fusion of the mental, submental and maxillary articulating areas; it carries one well developed seta and two minute setæ and also a patch of yellowish-brown, chitinous granulations on each side.

Labial stipites (fig. 3 and stil fig. 10) are amalgamated medianly and the fused formation is posteriorly limited by an unpaired, anteriorly concave, biarcuate, in the middle spear like chitinization; one long seta on the middle of each labial stipes. Ligula thick and short; ventral surface (li) with one seta, dorsal surface (ln) without seta.

Paragnatha (pgt fig. 8), a setose lobe; anteriorly slightly projecting over basal corner of ligula.

Hypopharynx (hyp figs. 8 and 10) membranous, on each side supported by a chitinous rod (hr) which at the entrance to œsophagus is connected with the corresponding rod from epipharynx (er fig. 7).

#### THORAX:

Tergum of prothorax simple with the different tergal areas very slightly indicated. Prescutal region with a shining yellowish-brown coloration on each side and one seta; scuto-scutellar region with two setæ and alar region without any. Meso- and meta-thorax with tergum divided into two folds or pleads, one formed by the prescutum and the other by the scuto-scutellum and the alar area. Prescutum (psc) with one seta; scuto-scutellum (sc-scl) with one distinct seta and besides with two very small setæ above and one very small seta below this seta; alar area (a) with one minute seta.

Epipleurum (e fig. 2) of prothorax large, triangular, glabrous, situated in front of tergum and above hypopleurum and separated



from this area by the ventro-lateral suture. Questionable if the spiracle carrying area belongs to pro- or to mesothorax; possibly it is a fused region formed by an anterior, spiracle-carrying upper part of the mesothoracic pre-epipleurum and the prothoracic post-epipleurum. Below the spiracle is a small, arched, dorsally concave patch of chitinous granulations. The mesothoracic pre-epipleurum proper (ea) is large, triangular, with one seta. Mesothoracic post-epipleurum (eb) narrow, elongate, situated behind the alar area (a); no seta. The metathoracic pre-epipleurum and post-epipleurum similar to the corresponding mesothoracic areas; anteriorly in upper corner of the metathoracic pre-epipleurum is a rudimentary metathoracic spiracle.

The hypopleural and sternal areas of all the thoracic segments are similar in position, shape and size.

Hypopleurum (hy) situated below the ventro-lateral suture, semioval with the upward curved margin dorsal; one or two fine setae present.

Presternum wanting in front of each segment; eusternum (est) large, unpaired, triangular; with one minute seta on each side. Prothoracic eusternum with a squarish large patch of chitinous granulations. Parasternum (or coxal lobe) (cx), representing the leg, triangular with rounded swelling below hypopleurum; four or five either normal or small setae present. Poststernellum (post) transversal, bandlike, with small median pit; glabrous.

#### ABDOMEN:

The first eight abdominal segments almost identical in every respect; the two last segments somewhat modified and reduced in size.

Tergum divided into prescutum (psc), scutum (sc), scutellum (scl) and postscutellum (cu<sup>1</sup>) which later is fused with or entirely constituting the upper cuneus of the intersegmental region. The ventral portions of the scutal and scutellar areas are fused together and form a spiracle bearing region which corresponds to the alar area (a) of the meso- and metathoracic segments. Prescutum (psc) with one fine seta; scutum proper (sc) without any; scutellum proper (scl) with two setae; the ventral subdivision of scutum and ventral subdivision of scutellum carry each one min-

ute seta; postscutellum ( $cu^1$ ) glabrous.

Epipleurum (e) ventrally limited by the ventro-lateral suture; median region or epipleural lobe with one seta; anterior or pre-epipleural region glabrous; posterior or post-epipleural region glabrous.

Hypopleurum (h) below the ventro-lateral suture, semioval with one normal and one minute seta.

Presternum wanting. Eusternum (est) subquadrangular, posteriorly transversely swollen; with one minute seta, not found on all segments. Parasternum (or coxal lobe) (cx) triangular; with one minute seta. Sternellum not developed. Poststernellum ( $cu^2$ ) transverse, bandshaped, glabrous, functioning as articulating skin, forming the lower cuneus of the intersegmental region.

Ninth abdominal segment smaller than the foregoing segments, with areas less distinct; setæ almost normal in arrangement and number.

Tenth abdominal segment small, wart shaped, with terminal round anus (an); two well developed setæ and a few minute ones.

Spiracles (fig. 9) bifore, with two rather short airtubes (t); each of these with about five incomplete annuli; spiracular opening circular (o).

Closing apparatus near the spiracle proper; consists of a well developed arm ( $a^1$ ) and a very short one ( $a^2$ ), a fleshy (c) and a hard and sharp pleat or valve (s) and a muscle (m) between the arms.

#### COMMENTS:

In 1920 the present author contributed a description with a plate of the larva of the cornpit weevil *Geraeus* (= *Centrinus*) *penicellus* (Herbst)\*. This genus belongs according to the characters found in imago to the same tribe, *Centrinides*, as does the *Limnobaris*. The systematic characters of the larvæ of the two genera corroborate this classification; but the larvæ differ noticeably in general habitus.

*The principal characters in common for the two genera are the following:*

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\* Journal Econ. Ent., vol. 13, 1920, p. 277-280.

Epicranium with posterior curved ridge (ecc).

Mandible with five apical teeth and the inside of the mandible concave.

Abdominal prescutum, scutum and scutellum all well developed on the mediodorsal side of the body.

Body sparsely beset with setæ. Prescutum with a single seta and scutellum with two or three well developed setæ.

Postscutellum and poststernellum forming a broad or very broad intersegmental region (cu).

Spiracles typically bifore; airtubes with few (about five) annuli; all spiracles located on side of body.

*The principal characters separating the two genera are the following:*

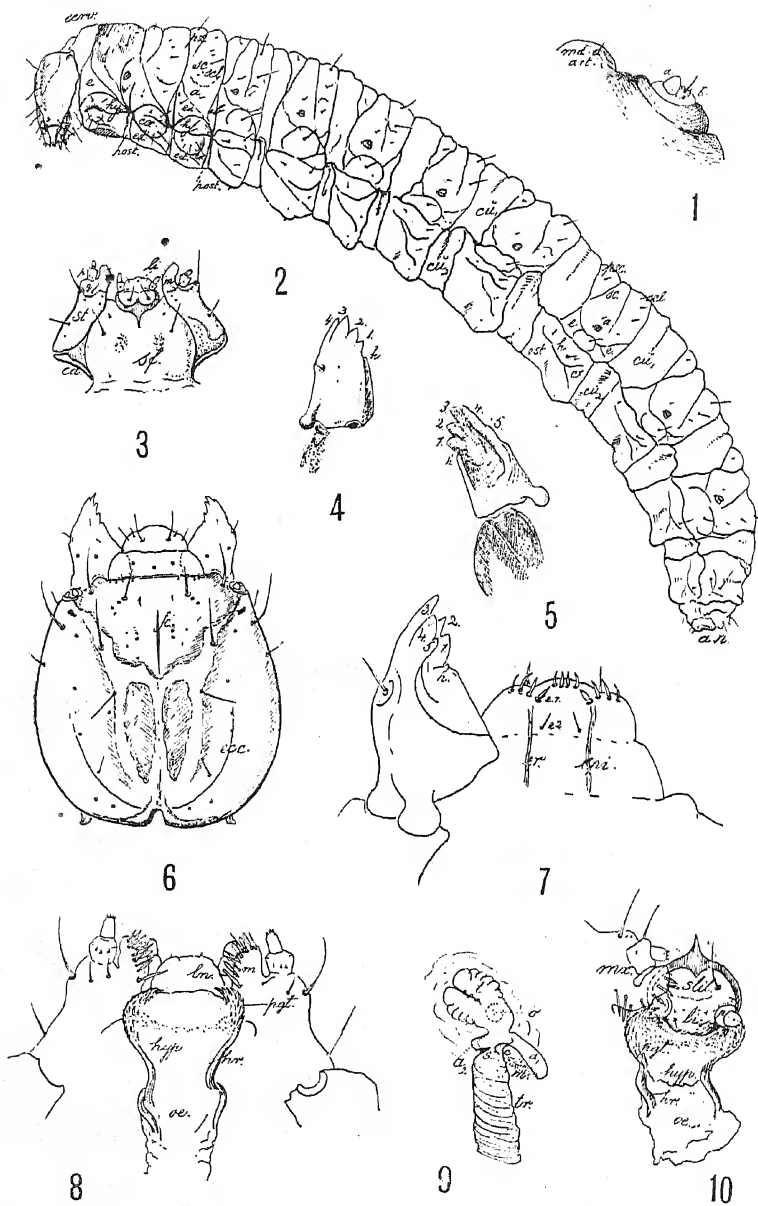
Head capsule in *Limnobaris* dorsally with a system of broad, whitish bands which form a large figure somewhat like a letter A; in *Geræus* without.

Prothorax in *Limnobaris* with patches of brownish chitinous granulations below the thoracic spiracle, above the foot-warts, and medianly on eusternum. In *Geræus* without.

Body of *Limnobaris* comparatively much longer than in *Geræus* due to the much broader intersegmental regions in the former genus.

Eight abdominal spiracle in *Limnobaris* of the same size as the other abdominal spiracles; in *Geræus* somewhat larger and placed more dorsal than the rest.





Waverly Bowring del.

*Limnobaris rectirostris* Leconte

## EXPLANATION OF PLATE XVI.

(All figures refer to *Limnobaris rectirostris* (Le Conte) and are made by the author.)

- Fig. 1. Right antenna: a, apical article; b, basal article; md. d. art., dorsal articulating process for the mandible.
- Fig. 2. Side view of larva: a, alar area; an, anus; cerv, cervical skin; cu<sub>1</sub>, dorsal cuneus (=postscutellum); cu<sub>2</sub>, ventral cuneus (=poststernellum); cx, parascutum (=coxal lobe); e, epipleurum; ea, pre-epipleurum; eb, postepipleurum; est, eusternum (=basisternum); h, hypopleurum of abdomen; hy, hypopleurum of thorax; post, poststernellum of thorax; psc, prescutum; sc, scutum; scl, scutellum.
- Fig. 3. Ventral (or subfacial) mouthparts from below: ca, cardo; g, palpiger; li, ligula ventral surface; m, mala (=maxillary lobe); p, maxillary palpus; sf, region formed by fused mentum, submentum and maxillary articulating region; st, stipes.
- Fig. 4. Mandible, lateral exterior face: 1, 2, 3, 4, 5, the five apical teeth; h, projection of inner dorsal margin.
- Fig. 5. Mandible, buccal inner face: explanation as for Fig. 4.
- Fig. 6. Dorsal view of head: ecc, curved ridge of epicranium; fc, dark line corresponding to carina on the interior surface of frons.
- Fig. 7. Epipharynx and mandible from below: 1, 2, 3, 4, 5 and h as in Fig. 4; e<sub>1</sub>, anterior pair of epipharyngeal setæ, e<sub>2</sub>, posterior pair; epr, epipharynx; er, epipharyngeal rod.
- Fig. 8. Structures on the ventral side of the buccal cavity: hr, hypopharyngeal rod; hyp, hypopharynx; ln, upper or buccal face of ligula; m, maxillary mala; oe, œsophagus; pgt, paragnatha.
- Fig. 9. Spiracle seen from inside with parts facing the cavity of the body: a, long arm of closing apparatus; a<sub>2</sub>, short arm of closing apparatus; c, soft fold of apparatus; m, muscle between arms; o, spiracular opening; s, hard fold of apparatus; t, airtube of spiracle; tr, tracheal branch to spiracle.
- Fig. 10. Eulabium bent and stretched out in plane with hypopharynx: hr, hypopharyngeal rod; hyp, hypopharynx; li, ventral face of ligula; mx, ventral face of maxilla; oe, œsophagus; p, labial palp; pgt, paragnatha; stil, stipes of labium.

## SOME ENTOMOLOGICAL AND OTHER BIBLIOGRAPHIES.

BY JOHN D. SHERMAN, JR.  
MOUNT VERNON, N. Y.

"How index-learning turns no student pale,  
Yet holds the eel of science by the tail."—POPE.

Bibliography to some is mere drudgery, an ever present and unavoidable evil; to others, however baffling it may be at times, it is an always interesting and fascinating pastime. To all students and workers in every field of interest and research, and especially for all writers, it is an aid and safeguard of extreme importance. The collector of books must study the subject for his guidance and protection while the financial and other success of the bookdealer depends very largely upon his bibliographical equipment. It is said that the largest order for books ever executed was given by Barney Barnato to Selfridges of London—for two copies, printed or typewritten, of every book mentioned in Gibbon's History of the Roman Empire. The list of these citations is an extensive bibliography.

Owing to their great importance as works of reference, bibliographies are perhaps, as a class, the most uniformly valuable of books, in a money sense, when one considers their actual cost of production (exclusive of time!) usually without any expense for plates or other illustrations. Even those relating to the least popular subjects are always in demand and often hard to obtain, being constantly used by their original or present owner, and seldom parted with; they are frequently "reserved" when a library or lot of books is sold.

Of the many general bibliographies, the "Manuel de Libraire" by J. C. Brunet is the one perhaps most often consulted and mentioned. Six volumes of this work were issued, 1860-1865, and two supplementary volumes in 1878 and 1880. The entire set has been reprinted in recent years and the reprint can be had at a moderate price. The earliest bibliographies of natural history known to me are the "Bibliotheca Animalis" by F. C. Bruckmann, a 12mo of 277 pages with an index of (56) pages, published at

Wolfenbittel in 1743, and the "Bibliotheca Regni Animalis atque Lapidei" by L. T. Gronovius, published at Lugduni Batavorum in 1760, the latter a rather imposing quarto of 326 pages. Both are interesting historically, though neither is of practical use at this time. Agassiz's "Bibliographia Zoologiae et Geologiae", in four octavo volumes, published by the Ray Society of London, 1848-1854, is a well known general catalogue of "all" books, tracts and memoirs on these subjects, many titles of which could have well been omitted. The work is by no means as important as its title and subtitle, and the names of its author and publishers would indicate.

The first great natural history bibliography to appear in the nineteenth century was the "Bibliotheca Historica Naturalis" of W. Engelmann, of which the first volume, covering the period 1700-1846, was published in Leipzig in 1846. A "Supplement Band", in two volumes, covering the years 1846-1860 and edited by J. V. Carus and W. Engelmann, appeared in 1861, and the period 1861-1880 is being covered by O. Taschenberg in a second supplementary series, the first signatures of which were published in 1886. To the end of 1923 eight volumes of the Taschenberg series, containing 6,620 pages have appeared, and "the end is not yet". This work is extensive, carefully subdivided and thoroughly indexed, and after a little practice its use is not nearly so complicated as it seems to be at first. It is in fact with but one possible exception the most important of all zoological bibliographies for the period 1700-1880.

Some of the best bibliographies are the catalogues of books contained in libraries of various institutions and societies. At least two of these are of great value in the field of natural history: The "Index Catalogue of the Surgeon General's Library" of the United States War Department, consisting so far of about forty volumes (First Series, 1880-1895, in sixteen volumes; Second Series, 1896-1916, in twenty-one volumes; Third Series begun in 1918), is an index by authors and by subjects of this library (in Washington, D. C.) of over 300,000 bound volumes, about 1,500 serials, and almost 500,000 pamphlets, a great many of which are of interest to entomologists and other naturalists.



By far the best of all natural history bibliographies is the "Catalogue of Books, Manuscripts, Maps and Drawings in the British Museum [Natural History]", in five quarto volumes, issued 1903-1915, and supplementary volume six (A-1) issued 1922, the six volumes containing in all some 3,000 pages closely but clearly printed in double column, chock-full of important facts and details as to plates, pagination, etc., where many of these library catalogues merely cite the date and place of publication and the size of the volume. Words fail to express the great worth of this excellent bibliography.

Some of the large libraries publish card indexes of their books on various subjects. The Library of Congress does, and so does The John Crerar Library of Chicago. These cards may be conveniently used as a nucleus for the worker's own detailed bibliographical card catalogue. Although the unit price of these cards is very reasonable, the vast number of titles makes the total cost on any subject quite considerable.

The Index Catalogue of Medical and Veterinary Zoology by C. W. Stiles and Albert Hassall is a valuable bibliography, by authors, published 1902-1910 in thirty-six parts, with 2,766 pages, as Bulletin 39 of the Bureau of Animal Industry, United States Department of Agriculture. Another very important bibliography is the "Catalogue of Scientific Papers" issued 1800-1900, published by the Royal Society of London, 1867 to date, in eighteen quarto volumes, the last one published (1923) finishing letter S of the Fourth Series.

There are at least three valuable bibliographies of serial publications: Scudder's "Catalogue of Scientific Serials (1633-1876)" issued as Special Publication Number One (1879) of the library of Harvard University; H. C. Bolton's "Catalogue of Scientific and Technical Periodicals" (1665-1895) published (second edition, 1897) by the Smithsonian Institution; and the "Handbook of Learned Societies and Institutions in America", this last being Publication 39 (1908) of the Carnegie Institution of Washington. In June, 1923, the London book dealers, Wheldon and Wesley, issued a priced catalogue (New Series, Number 7) which is a complete list of the many titles on natural history published by

the British Museum down to that time. Similarly, in 1911, the Engelmann house, the great German publishers of scientific works, issued a "Jubiläums Katalog" listing all of its own publications during its existence of one hundred years, with a lot of valuable information about them.

Beginning 1835, the "Archiv für Naturgeschichte" has one volume each year giving the titles of the publications of that year relating to natural history (1835-1911; "Zweiter Band, Bericht über die Leistungen im Gebiete der Naturgeschichte". 1912 to date; "Abteilung B. Jahres-Berichte"). This work and the similar "Zoological Record" issued annually since 1864 by the Zoological Society of London, both carefully subdivided as to subjects, give not only a very complete list of titles with pagination, etc., but also an exhaustive digest of their combined contents systematically arranged. One must refer constantly to either one or the other, or both, of these records. Of the two, the "Zoological Record" is preferred by most English speaking people, and it is to be hoped that zoologists will give it the support necessary for its continuance. Volume 59, for 1922, is being published and the later volumes are in course of compilation. The Zoological Society of London, though willing to lose as much as £500-a-year on this undertaking, feels that the balance of its cost must be met by other organizations and individuals. The "Insecta" portion is of course by far the most extensive part of the work, and it should be subscribed for by every working entomologist, both professional and amateur.

The "Zoologischer Jahresbericht" of the Zoological Station at Naples, begun in 1879, and edited at first by J. V. Carus, was maintained for several years. In this work under each subject is a list of titles followed by a general resumé of the literature with references to the various titles giving a general idea of each one. This is considered by some to be an ideal bibliographical record. The *Zoologischer Anzeiger*, 1878 (Volume 1) to 1895, also contains a "Literatur—uebersicht", an annual record of publications, which, beginning 1896, has been continued as "*Bibliographia Zoologica*", both in book form and also as a card catalogue (part of *Concilium Bibliographicum*) edited by J. V. Carus and (after-

wards) H. H. Field, giving on cards the same information contained in the "Zoological Record" and "Archiv für Naturgeschichte". Friedlander's "Naturae Novitates", instituted in 1879 by the great German booksellers, is a very useful record of publications as they appear, and the similar "Bibliotheca Historico-Naturalis et Physico-Chemica (et Mathematica)" edited by E. A. Zuchold was issued semi-annually, 1851-1888, being distributed by F. Westermann & Co. of New York City and other foreign booksellers.

Coming to strictly entomological bibliographies we at once think of Hagen's "Bibliotheca Entomologica" published by Engelmann in 1862, a model work in every respect with its great attention to detail and copious index. The inestimable value of this work is being forcibly expressed in a rapidly advancing money value, and it has become so scarce and it is so essential that it will undoubtedly some day be reprinted. Although many additions and corrections have been published by various writers, and although Hagen's own copy in the Museum of Comparative Zoology at Cambridge is literally honeycombed and greatly enlarged with such corrections and additions, the work is marvelously accurate and complete. Those laconic (and *expensive*) words—"Not mentioned by Hagen" and "Not in British Museum Catalogue"—sometimes quoted by the delighted book dealer or bibliophile are eloquent tributes to the surpassing excellence of these two great bibliographies.

It would be interesting to have a complete list of the printed additions and corrections to Hagen's work. Those known to me are "Addenda und Corrigenda", by Dr. K. W. von Dalla Torre, in Entomologische Nachrichten (Vol. 4, 1878, pages 324-330; Vol. 6, 1880, pages 125-129, 137-140, 168-171, 261-267; and Vol. 7, 1881, pages 45-48, 163-170); "Ergänzungen und Nachträge", by Dr. G. Kraatz, in Berliner Entomologische Zeitschrift (Vol. 18, 1874, pages 209-226); "Zusätze und Berichtigungen", by Prof. Dr. H. M. Schmidt-Gäbel, in Deutsches Entomologische Zeitschrift (Vol. 20, 1876, pages 145-160); and "Contributions to Entomological Bibliography up to 1862", by Albert Müller (No. 1 in Transactions Entomological Society of London, 1873, pages

207-217, and Nos. 2 and 3, of 15 and 16 pages respectively, separately published by E. W. Janson, London, also in 1873).

Another valuable and interesting entomological bibliography not so well known and by no means so useful as that of Hagen was published in Paris twenty-five years earlier (1837). This "Bibliographie Entomologique" by A. Percheron is also in two volumes and, although lacking entirely the details of the Hagen work, it contains several interesting features, such as the chronological tables of works on various subjects and the seventy-five-page list of anonymous titles. It is one of the earliest of the modern bibliographies of natural history, antedating the Engelmann and Agassiz general works by about ten years. A still earlier entomological bibliography, seldom seen, is the "Bibliographie Entomologique" by Charles Nodier, published in Paris, "An I" (1801). It is a 16mo of 8 and 24 pages. The author was born in 1783 and there is a note in Hagen that he made a great effort to recall this youthful production. There is a copy of it in the Library of Congress. The "Lexicon der Entomologischen Welt, der Carcinologischen und Arachnologischen", "adressenbuch, etc.," published at Stuttgart, 1846, is a semi-bibliographical work of 144 pages, a sort of an entomological "Who's Who". The author is Johannes Gistel. An unimportant but curious attempt at entomological bibliography, contributed by Dr. Wm. Sharswood of Philadelphia, is the "Bibliographia librorum entomologicorum in America boreali editorum", found in *Linnæa Entomologica*, Vol 13, 1859, pages 333-353, and Vol. 14, 1860, pages 256-264. Another project of Dr. Sharswood—carried out many years later by the Boston Society of Natural History—was the idea of publishing under one cover a collection of the entomological writings of Thaddeus William Harris, and advertising prospectuses of this work appeared in various entomological journals of the period.

The Catalogue of the Library of the Entomological Society of London (1893, 312 pages) with the Supplementary Catalogue (1900, 147 pages) does not profess to be anything more than a catalogue, but it cites very faithfully the name of the serial, with the date and volume number, in which a great many papers ap-

peared. A very valuable entomological bibliography published in our own country is the "Catalogue of Publications relating to Entomology in the Library of the United States Department of Agriculture" (Bulletin 55 of the Library, U. S. D. A.) prepared under the direction of the librarian, Josephine A. Clark, and published in 1906. This is a volume of 562 pages, and gives under each title full and exact details of size, pagination, method and place of publication, and numerous remarks and annotations. The titles are given in many sub-divisions, including an arrangement by families under each order, with a complete author index and index by families, each index including *all* the titles under one alphabet.

Our government, especially through the Bureau of Entomology of the Department of Agriculture, has published not only many entomological books and papers, but also several valuable entomological bibliographies. In addition to the one just mentioned there is, first and foremost, the "Bibliography of American Economic Entomology" prepared by Samuel Henshaw and Nathan Banks and published, 1889-1905, in eight parts, with 1,318 pages. This work, now thoroughly "out of print", has been continued by the American Association of Economic Entomologists in its "Index" volumes covering (I, by Nathan Banks) the years 1905-1914, and (II, by Miss Mabel Colcord) the years 1915-1919. These later "Index" volumes are arranged according to species of insects and not by authors' names.

Bulletin 19 (1888) and New Series, Bulletins 24 (1900) and 81 (1910) of the Bureau of Entomology are three editions of a "List of Publications relating to the Entomology of North America". The first of these is by Dr. E. A. Schwarz, who has always been, and still is, one of our best informed authorities on the bibliography of entomology. The later editions were prepared by Nathan Banks. Circular 76, New Series, of the Bureau of Entomology, gives a list of the publications of the Bureau revised to February 1st, 1910. Miss Colcord has brought this list down to date, but her manuscript has not yet been published. In the Proceedings of the Entomological Society of Washington, Vol. 25, No. 1 (January, 1923) my friend Joe S. Wade gives a very useful collation and

check-list of all the various serial and other government publications of entomological interest.

Such works as the Aldrich "Catalogue of North American Diptera" (1905), faithfully modeled after the second edition (1878) of the Osten Sacken catalogue, the Van Duzee "Catalogue of Hemiptera of North America" (1917), the Leng "Catalogue of the Coleoptera of America, North of Mexico" (1920), and the monumental *Catalogus Hymenopterorum* by K. W. von Dalla Torre (in ten volumes, 1892-1902), are of course primarily bibliographical works. The Aldrich Catalogue, for example, contains an annotated list of titles occupying some seventy pages, while the Leng Catalogue has a separate bibliography of over 4,000 titles (pages 367-444). Two American entomological bibliographies are expected to appear during the coming year: an annotated bibliography of works relating to the Hemiptera-Heteroptera of North America, by Prof. H. M. Parshley, of Smith College; and Prof. Z. P. Metcalf's bibliography of works relating to North American Hemiptera-Homoptera.

Nearly every comprehensive entomological book of real merit contains a lot of bibliography. Even the early naturalists did not neglect to give due credit to the works of their predecessors and contemporaries: e. g., Linné in the first edition (1746) of his "Fauna Suecica" mentions forty books on insects. There is to be sure one notorious exception to this custom in the case of J. C. Schaeffer, who in his "Elementa Entomologica" (1766) and the appendix thereto (1777) fails to mention the name or work of any other authority. In Lowne's great work on the Blow Fly (1890-1895) there is a bibliography for each chapter. Our own Prof. W. M. Wheeler in his recent book, "The Social Life of Insects", devotes pages 285-355 to an invaluable annotated bibliography.

There is in existence in this country at least one very complete *unpublished* entomological bibliography—the very extensive card catalogue of over 3,900 works on Orthoptera prepared and maintained by A. N. Caudell. Dr. Bequaert has a similar card-index of literature on Hymenoptera and Diptera. There are many other manuscript entomological bibliographies, many of which are

mentioned in publication number 45 of the "Reprint and Circular Series" of the National Research Council.

R. Friedländer and Son, of Berlin, dealers, issued monthly, 1900-1914, an extremely useful "Entomologische Litteraturblätter" giving the current publications, including those appearing in the various serials. Beginning 1913 we have had the "Review of Applied Entomology" published monthly by the Imperial Bureau of Entomology, London, in two "Series", "Agricultural" and "Medical". This is far more than a bibliography. It is a digest of the contents of nearly every entomological work of the slightest agricultural or medical interest, so that a great many of the systematic publications are also included. Our own "Entomological News" has in each issue a long classified list of items relating directly or indirectly to our North American fauna. The early volumes of "Psyche" were "strong" on bibliography, but the result was entirely too complicated to be of much use.

It is frequently desirable to know just what titles are contained in important serials. A common feature of German and other entomological serials in years gone by was the "Repertorium" of entomological contents of various periodicals, very often starting with the year 1862 (date of Hagen). In the case of such serials as the "Proceedings of the Academy of Natural Sciences of Philadelphia", the "Proceedings of the United States National Museum", the "Proceedings of the Zoological Society of London", the "Annales de Société Entomologique de France", etc., when obtainable I bind together either the regular "contents" or those printed on the covers, supplying those missing in manuscript. If the "contents" as printed are not to be had, it is often worth while to make up a card catalogue of the contents of the various volumes. Biographies and obituary notices of distinguished entomologists are not to be overlooked in the search for bibliographical information. They are among the most valuable "sources".

A few insects of great economic importance, such as the silkworm and the honey bee, have such an extensive bibliography that it is practically impossible for it to be included in general works. The French government undertook the publication of a bibliography of literature relating to the "Phylloxera", but found

it to be so extensive that after a few volumes the work was abandoned.

There should be mentioned finally, as very often of extremely great bibliographical value, the regular priced catalogues issued by certain book dealers, notably those of the type originating I believe in Germany cataloging not only the important books, but also thousands of brief pamphlets and excerpts, giving in some cases the details of pagination, etc., and the entirely different catalogues of the English house of Quaritch—the greatest of all book dealers—whose catalogues, besides giving an absolutely accurate description of the books which they offer for sale, are always overflowing with important and fundamental facts relating to them. The 1881 Quaritch catalogue, issued in many sections, and printed both in octavo and in quarto size, is an early example of these wonderful catalogues which continue always to improve, and which are thoroughly satisfying works of reference both for the bibliophile and for other dealers. They are indeed models for the inspiration and emulation of the latter, and may well be studied and followed by all in the preparation and study of bibliographies.

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### MELANOPLUS DIFFERENTIALIS (THOMAS) A NEW GRASSHOPPER TO THE STATE OF NEW YORK.

On August 30, 1924, a male of this species was found in the salt meadow among rank vegetation near Old Place on the north shore of Staten Island. The first specimens to be reported from the eastern United States appear to have come from cranberry bogs in New Jersey and are mentioned in the second "List of the Insects of New Jersey" by Prof. J. B. Smith. In the vicinity of Philadelphia others were found by Wenzel, Kemp and Seiss in 1896. (See notes on this species by James A. G. Rehn in the Canadian Entomologist for January, 1900.) In 1908 *differentialis* was collected near Dennisville in southern New Jersey by the writer, and later it was taken at the same locality by Dr. Henry Fox. It is a very common species over most of the western states where it is sometimes destructive. It appears to be spreading along the Atlantic coast both to the north and south of Philadelphia.

WM. T. DAVIS.



## PROCEEDINGS OF THE NEW YORK ENTOMOLOGICAL SOCIETY

MEETING OF DECEMBER 4, 1923

A regular meeting of the New York Entomological Society was held in the American Museum of Natural History at 8 P. M. on December 4, 1923, President Harry B. Weiss in the chair with 14 members and five visitors present.

The following new members were elected:

Dr. Philip H. Garman, Conn. Agricultural Experiment Station, New Haven, Conn.

Prof. G. C. Crampton, Mass., Agricultural College, Amherst, Mass.

Mrs. Emilia V. Armstrong, 540 West 112th St., New York City.

Mr. Davis presented photographs he had taken of Mrs. Annie Trumbull Slosson in her home on November 20, 1923.

It was announced that the entomological collections of the late Edgar L. Dickerson had been presented to the American Museum through Mr. Weiss.

Mr. Nicolay gave an interesting account of the numerous collecting trips he had made during the year with various companions including Messrs. Quirsfeld, Shoemaker, Notman, Barber, and Mr. Mason of Philadelphia. He spoke of the Canarsie locality for *Elaphrus fuliginosus* being nearly ruined by building operations, of the western side of Greenwood Lake as affording in its craggy forest of pines and deciduous trees excellent collecting, of the swamp near Orangeburg station on the West Shore R. R., as a locality for *Elaphrus cicatricosus* and many weevils. Other localities visited were Rosedale, L. I., Washington, D. C., Montclair and Roselle, N. J., and the banks of the Wissahicken near Philadelphia, the most northern locality for *Sphaeroderus stenostomus*. Mr. Nicolay's remarks were illustrated by a large collection of weevils made during these trips, and by many references to other species of beetles he had found.

Mr. Leng spoke of "The Genus *Serica* and the work of Mr. R. W. Dawson therein", illustrated by his own collection as arranged by Mr. Dawson with the genitalia extracted and prepared for study. The genus included only four species when Dr. Leconte studied it between 1850 and 1856. This number was increased to 15 by Leconte and to 22 by subsequent authors; which number has again been doubled by Mr. Dawson's descriptions published in our Journal. The patient industry and skill exhibited in the plates published and in the specimens (which are deposited in the American Museum and the public museum on Staten Island) are admirable; but the identification of *Serica* species will not in future be an easy task.

Mr. Davis exhibited a living specimen of *Cychrus viduus* found November 30 near Bull's Head, Staten Island, by Mr. Edward J. Burns and him-

self and remarked that the locality was a forested area protected from fire by a bend in the swamp ditch and that the specimen shown was the first seen since about 1890. Mr. Davis also read an interesting letter from Charles Dury, now 76 years old, describing former localities for *Cychnus* near Cincinnati; and exhibited Circular No. 68, N. J. Department of Agriculture, on the Chinese Mantis by Mr. Weiss.

#### MEETING OF DECEMBER 18, 1923

A regular meeting of the New York Entomological Society, was held at 8 P. M. on December 18, 1923, in the American Museum of Natural History, President Harry B. Weiss in the chair with 18 members and one visitor present.

The following new members were elected:

Alex. D. MacGillivray, 603 West Michigan Ave., Urbana, Ill.

Wm. F. Lawler, Jr., 39 Lincoln Park, Newark, N. J.

Caryl Haskins, 4 Elk St., Albany, N. Y.

Mr. Jones read a paper "Psychid Discoveries and Re-discoveries", illustrated by four boxes of specimens of the moths and their larval cases, which will be published later. After reviewing the status of the 31 species that have been described, some from the larval case only, others from uniques, and pointing out that 25 were represented either in his own or the museum collection, he described the efforts he had made between September 8 and October 31 to trace the species that were inadequately known. The results were already gratifying and especially in regard to *carbonaria*, originally described from Bosque Co., Texas, definitely. He then considered the life history, pointing out that common as the bag worm is, the exact method of fertilization of the eggs is unknown. He described several studies he had made indicating a possibility of fertilization being effected after the egg mass, consisting of moist, tender, thin shelled eggs, had been deposited.

His remarks were followed with great interest and were discussed by Messrs. Weiss, Sturtevant and Lutz.

Mr. Weiss spoke of "Progress of Third Year's Work against the Gipsy Moth in New Jersey", stating that by the expenditure of \$750,000 in the three years the outlook was encouraging for an effective control in the level country. About 400 men had been employed in scouting for colonies of egg masses, the number found having diminished from 855 in the first year to 98 in the third, in creosoting the egg masses found, and in spraying and banding the trees. Thus far in the fourth year's work only 25 colonies had been found, but as some of these were in the heavily wooded Watchung Mts. where effective scouting was more difficult, he was not free from anxiety. The incidental damage to farm animals, unduly magnified and even falsified, was also at times a troublesome matter, of which Mr. Weiss gave some remarkable instances.

Mr. Angell exhibited specimens of *Cychnus hemphilli*, recently received from Utah, and of artificial insects.

Mr. Davis referred briefly to the Morrison prize awarded to Dr. Lutz.

#### MEETING OF JANUARY 15, 1924

The annual meeting of the New York Entomological Society was held at 8 P. M., on January 15, 1924, in the American Museum of Natural History, President Harry B. Weiss in the chair, with 19 members and six visitors present.

The Curator reported the use being made by Boy Scouts of the local collection.

The Nominating Committee reported their selection of the following officers and committees for 1924. There being no other nominations the Secretary, as instructed by motion duly seconded and carried, cast an affirmative ballot thereby electing:

President—Harry B. Weiss.

Vice-President—Frank E. Lutz.

Secretary—Charles W. Leng.

Treasurer—William T. Davis.

Librarian—Frank E. Watson.

Curator—A. J. Mutchler.

Executive Committee—H. G. Barber, George P. Engelhardt, G. C. Hall, A. H. Sturtevant and L. B. Woodruff.

Publication Committee—F. E. Lutz, Howard Notman, C. E. Olsen and J. D. Sherman, Jr.

The Secretary reported the death on December 23, 1923, of Mr. Edwin A. Bischoff and was instructed to prepare a resolution of regret and sympathy to be entered on the minutes and sent to Mr. Bischoff's wife and family.

WHEREAS the New York Entomological Society has learned with sorrow of the death on December twenty-third, nineteen hundred and twenty-three, of Edwin A. Bischoff, long an esteemed member of the Society and a coleopterist of repute, be it

RESOLVED that this expression of the Society's appreciation of his work in entomology and the Society's regret at his early death be entered upon the minutes, and

RESOLVED that a copy hereof be sent with the sympathy of the Society to his wife and family.

Dr. George Child, American Museum of Natural History, was elected a member of the Society.

Dr. Lutz presented under the title "Notes on the Comparative Anatomy of Bees" an elaborate paper, illustrated by many drawings and tables, in which the wing venation first and the mouth and other structural parts

second were considered for Meloponidæ and Trigonidæ; concluding with a discussion of the results from various points of view.

His remarks were followed with interest and were discussed by Dr. Sturtevant and others.

Mr. Leng read a humorous composition by Mr. Percy L. Sperr entitled "The Man of Science, Meet Him Again Please," in which some of the events recounted at a recent meeting and others were recalled.

Dr. Lutz exhibited for Mr. Bell a queen hornet found January 7, 1924, at Flushing, L. I.

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### NOTES ON ASILUS SERICEUS SAY (DIPTERA, ASILIDAE).

This robber fly, generally common enough, seemed to occur in more than usual numbers during the summer of 1924 and the writer was interested in observing its attacks upon insects of several orders. It is apparently one of the most voracious of its kind and is powerful enough to grasp and kill butterflies larger than itself. During the many instances this species was observed pursuing and capturing its prey, it was noted that so long as the pursued did not fly, it was apparently safe and although it might walk around on a flower or some other object in plain view of the robber fly, no attempt was made to capture it until it took wing and then it was quickly seized and killed. Sometimes the intended victim would be aware of the pursuit and would drop into the vegetation, thus escaping, but this evasion did not always work for if the robber fly was close it also would dart into the vegetation and sometimes succeed in making a capture.

The writer was chiefly interested in those instances where *Hesperiidæ* were captured, and among the several species of this family of butterflies found in the grasp of *sericeus*, was one specimen of *Epargyreus tityrus* Fabricius, which made a heavy load for the fly to carry. In this case it was unable to go very far with it at a time. Even this robust and swift butterfly does not always escape.

E. L. BELL.

## THE ACIDITIES WITHIN THE ALIMENTARY TRACTS OF INSECTS.

Of late entomologists and zoologists are giving increasing attention to the acidities and alkalinities within the alimentary tracts of insects in view of the possible bearing of such conditions on the solubilities of poisons, development of intestinal parasites, etc. Such acidities and also alkalinities are expressed as hydrogen ion (pH) concentrations by readings of a scale in which pH 7 is considered as the neutral point; the lower the figure, the greater the acidity. The hydrogen ion concentration may be determined by an electrical method or by means of colorimetric comparisons with a set of colored standard solutions whose pH values are known.

To mention only two recent papers on this subject, Dr. W. J. Crozier, writing in the "Journal of General Physiology" (vol. VI, No. 3, pp. 289-293), finds that in the larvæ of *Psychoda* and *Chironomus* (Diptera) "The ingested food is subjected first to a faintly alkaline salivary juice, passes then through a distinctly acid cardiac chamber, thence to a no less distinctly alkaline portion of the gut" (mesenteron) wherein the food passes most slowly and absorption is most active. He states that in the larvæ studied the hindgut is probably of minor importance in digestion and absorption and that its acidity is due to the discharge from the malpighian tubules. Dr. Crozier gives the typical hydrogen ion concentrations within the regions of the digestive tract as follows: cesophagus 7.1; cardiac chamber 6.2; mesenteron (stomach) 7.5; hindgut 6.4.

Mr. Harrison M. Tietz in the "Journal of Economic Entomology" (vol. 17, No. 4, pp. 471-477) reports that the hydrogen ion concentrations in the alimentary tract of the honeybee are as follows: cesophagus 7.0 (?); stomach plus the honey stomach 5.6 and intestine 7.4. He also found that the solubility of arsenate of lead "does not seem to increase when the powder is acted upon by the fluids in the cesophagus" and that the secretions of the honey stomach and stomach render the arsenate of lead at least one and one-quarter times as soluble and the action of the intestinal juices, at least three and three-quarters times as soluble as it would be in water alone.

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